

The drum-dryer mixing process shall provide positive weight control of the cold aggregate feed with a belt scale or other device to automatically regulate the feed gate and permit instant correction of variations in load. The cold-feed flow shall be automatically coupled with the bitumen flow to maintain the required proportions. The system shall be equipped with automatic burner controls and shall provide for temperature sensing of the bituminous mixture at discharge.

The Contractor shall have, for review by the Department, a copy of the manufacturer's manual for the plant. The pitch of the drum shall be no greater than 3/4 inch per foot or as recommended by the manufacturer.

When plant production is changed during normal operations, the temperature of the mix shall be maintained within 20°F. of the average temperature of the mix produced within the preceding 1/2 hour of the plant production change.

- B. **Surge Bins.** The plant shall have adequate bin storage for the hot mix to ensure continuous production operations. Surge bins for hot storage shall have batchers, baffle plates, or other approved devices to minimize segregation during loading and unloading. Surge bins which permit an uninterrupted free fall of material from the loading conveyor shall not be used.

152.05 MILLING MACHINE.

The milling machine shall be a self-propelled machine specifically designed to mill and remove existing asphalt pavement to a specified depth, profile, cross slope, and surface texture. The machine shall be of a size, shape, and dimensions which does not interfere with safe traffic passage adjacent to the work.

The machine shall have a control system to automatically control the elevation and transverse slope of the milling head. A 15-foot minimum length skid, rolling straight-edge or other approved device shall be used to establish the grade reference for control of the milling head. The system shall permit the grade reference device to operate on either side of the milling machine, and shall maintain the desired transverse slope regardless of changes in the elevation of the milling head.

Conveyors capable of side, rear, or front loading shall be provided with the necessary equipment to transfer the milled material from the roadway to a truck.

152.06 ASPHALT TRANSPORTER.

Tank trucks used to transport bituminous material shall be sealed at the refinery and shall be equipped with a bitumen sampling valve. This valve shall be conveniently located for sampling, preferably in the lower half of the rear bulkhead and at least one foot from the shell. The valve shall be inside the tank with the valve stem and outlet extending outside the tank.

SECTION 153 PORTLAND CEMENT CONCRETE EQUIPMENT

153.01 BATCHING AND WEIGHING EQUIPMENT.

- A. **General.** The batching plant, including its supports and foundations, shall be designed to safely withstand any operating stresses. The plant shall be leveled to

maintain accuracy of the weighing mechanism. Bins with suspended weighing equipment shall be fully loaded for a minimum of 2 hours before testing the weighing equipment. The weighing mechanism shall be constructed or shielded to provide protection and accurate operation during windy or other adverse weather conditions.

The batching plant shall include individual bins or a bin with individual compartments, for each separate aggregate component, constructed to prevent intermixing of aggregate before weighing. The weigh hopper or hoppers shall be charged to assure the batched weights are within the tolerances specified in Section 802.04 B.1. The separate aggregate components for each batch may be weighed cumulatively in a single hopper or separately in individual hoppers. When weighed cumulatively, the aggregate shall be weighed in the specified sequence.

Bulk cement and fly ash shall be weighed in a hopper and kept separate from the aggregates. The hoppers shall be attached to a separate scale for weighing component materials. Bulk material shall be charged into the weigh hopper from a weatherproof bin equipped to permit accurate control of the quantity of material withdrawn for each batch, within the tolerance specified in Section 802.04 B.1.

The hoppers for weighing any ingredients shall be freely suspended on scales without other contacts that may affect proper functioning of the scales. The weigh hoppers shall complete discharge without loss of materials and without manual assistance. If complete discharge cannot be obtained, the hoppers shall be equipped with a vibrator. Hoppers shall hold the materials being weighed without spillage and the discharge gates shall not leak when closed.

Hoppers which are loaded by compressed air shall be vented to relieve air pressure build up. This build up could cause faulty operation of the weigh mechanism or result in false scale readings.

Weigh hopper scales shall be either the beam or springless dial type, of standard make and design equipped to permit quick, easy balancing at zero load. The scales shall be accurate within a tolerance of 0.5% throughout the range of use. For dial scales the predetermined batch weight of each ingredient being weighed shall be marked on the dial face by an adjustable pointer. Beam scales shall be equipped with an "over and under" indicator to show the beam in balance at zero load and provide positive visual evidence of overweights and underweights. The beam scale shall include a separate beam for each ingredient being weighed.

The Contractor shall have the scale tested and certified by the Department of Weights and Measures or a certified scale service within 6 months before use on the Project.

The scales shall be tested as often as the Engineer deems necessary for continued accuracy. The Contractor shall provide at least one standard 50-pound test weight for each 500 pounds of capacity of the maximum size scale; however, not less than 10 nor more than 20 such test weights shall be required. Any scale which cannot be maintained accurately within the specified tolerance shall be replaced or repaired. The Contractor shall make all arrangements and bear all expenses incurred in having the scales tested and certified.

- B. Automatic Batching Equipment.** Automatic batching shall be required for P.C.C. Pavement projects with 3000 or more cubic yards of concrete. The auto-

matic batching equipment shall conform to the general requirements of Section 153.01 A and to the additional requirements of this Section.

For each batch a single actuation of a starting device shall be the only manual operation permitted to proportion the designated quantity of each ingredient into the weigh hopper or hoppers.

The automatic batching equipment shall be interlocked so that: (1) The charging mechanism of any weigh hopper cannot be opened until the scale has returned to zero and the discharge mechanism of the weigh hopper has closed; (2) the discharge mechanism of the weigh hopper cannot be opened if the charging mechanism is open; (3) the discharge mechanism cannot be opened until all ingredients have been batched to their designated weights, within the specified tolerances; and (4) if separate aggregate components are weighed cumulatively in a single hopper, the aggregates are weighed in the specified sequence.

The designated batch weight of bulk cement and fly ash and of each separate aggregate component shall be preset at the direction of the Engineer before the batch cycle starts.

The automatic scales for weighing bulk cement and fly ash shall be equipped with an automatic recording device to graphically record or print the batched and empty weights. Graphic recording charts shall be graduated for time intervals not exceeding 15 minutes, and shall have minimum weight graduations not greater than 0.1% of the nominal capacity of the scale. If printed tapes are used, they shall record the consecutive batch number; and the minimum weight graduation printed on the tape shall not exceed 0.1% of the nominal capacity of the scale. The weight recording mechanism shall be accurate within one graduation of the chart or tape.

The automatic batching equipment shall be capable of conversion to manual operation. Manual operation will be limited to 12 hours for reasons of breakdown in the automatic equipment, except by written permission of the Engineer.

153.02 MIXERS.

- A. **Stationary Mixers.** Each mixer shall be a mechanically operated revolving drum or revolving blade type. The mixer shall have attached, in a prominent place, a manufacturer's certified rating plate showing the maximum mixer capacity, the recommended speed of rotation of the drum or blade (rpm), and the mixer's registration number. The mixer shall have a rated capacity of not less than 10 cubic feet. A mixer of smaller capacity may be approved for items of work other than Concrete Pavement (Section 550) and Concrete Structures (Section 602) provided the volume of concrete required for the pour is less than 10 cubic yards.

The total production capacity of the mixer or mixers shall be adequate to furnish concrete at a rate which permits uninterrupted placement and finishing operations.

The mixer shall be cleaned at intervals required to keep deposits of hardened concrete from accumulating in the mixer drum. The pick up and throw over blades shall be repaired or replaced when blade wear exceeds 10% of the original blade depth. The Contractor shall: (1) have available at the job site a copy of the manu-

facturer's design showing the original layout and dimensions of the blades, or (2) place permanent marks on each blade to show points of 10% wear from new conditions.

Multiple compartment mixers shall be designed for synchronized operation of the charging, mixing, transfer, and discharge cycles so that a single batch will not become intermingled in the mixer with material from another batch.

Each mixer with a capacity of 10 cubic feet or more shall be equipped with a water measuring system. When the mixer has a rated capacity less than 10 cubic feet, the mixing water may be measured and added by approved manual methods. The water measuring system may be mounted on a mixer or may be a separate unit located at the mixing site. The system shall deliver the designated quantity of water for each batch within the tolerance specified in Section 802.04 B.1.e. The system shall be constructed so the water flow to the mixing drum automatically stops when the designated quantity of water has been delivered. The system shall be readily adjustable and shall have an accurately calibrated indicator showing the quantity of water measured for each batch. Outside taps and valves or other approved means shall be provided to permit convenient and accurate calibration of the water measuring system. The Contractor shall furnish all equipment and assistance necessary to calibrate the system before use and as necessary to maintain the specified tolerances.

A visual volumetric measuring unit must be used in all admixture dispensing systems where the admixture dosage rate does not exceed 32 fluid ounces/100 pounds of cement. The measuring unit shall be located where the plant operator can clearly read the index points on the measuring unit from the operator's station. A measuring unit will not be permitted in a plant where the batching office and batch plant are widely separated or where the batch cycle time is insufficient to allow the fill and discharge of a measuring unit. In such cases, a flow indicator must be installed in the admixture line to indicate to the plant operator the start and completion of each batch. Also, a suitable measuring unit must be installed in the line to allow checking the dispenser accuracy periodically. A separate dispenser is required for each admixture.

The revolving drum type stationary mixer shall have a manufacturer's guaranteed capacity capable of mixing and holding a volume of concrete equal to its rated capacity plus 10% without spillage. The revolving blade type stationary mixer shall mix and hold a volume of concrete equal to its rated capacity without spillage. The speed of rotation of the mixing drum or blades shall be as specified by the manufacturer.

When the stationary mixer has rated capacity of less than 10 cubic feet, the mixing cycle may be timed by any method approved by the Engineer. When the rated capacity of the mixer is 10 cubic feet or more, the mixer shall be equipped with controls for automatically timing the mixing cycle for each batch. The automatic timing controls shall be interlocked with the discharge mechanism so no part of the batch can be released until the designated mixing time has elapsed. The completion of each mixing cycle shall be indicated by an audible or visual signal. The timing mechanism shall be constructed or enclosed so it can be locked when directed by the Engineer. If the timing device or interlocks break down or fail to operate properly, operation of the mixer may be temporarily controlled by an approved manual timer until repairs can be made, provided a mixing time for each

batch of not less than 90 seconds can be maintained. If repairs are not completed within 72 hours, further use of the mixer shall be discontinued. Each stationary mixer used to mix concrete for pavement shall be equipped with an approved mechanical batch counter.

- B. Truck Mixers.** The maximum cubic yard capacities for mixing and agitating shall be as guaranteed by the manufacturer on the rating plate attached to the truck mixer. The mixing speed for the revolving drum type mixer shall be not less than 4 revolutions per minute of the drum, nor greater than a speed resulting in a peripheral velocity of 225 feet per minute at the largest diameter of the drum. The mixing speed for the revolving blade type mixer shall be not less than 4 nor more than 16 revolutions per minute of the mixing blade. The agitating speed for either the revolving drum or revolving blade type mixer shall be not less than 2 nor more than 6 revolutions per minute. The truck mixer shall be equipped with a revolution counter which registers the number of revolutions of the mixing drum or blades when operated at mixing speed.

The mixer shall be cleaned at intervals, required to keep deposits of hardened concrete from accumulating in the mixer drum. The pick up and throw over blades shall be repaired or replaced when blade wear exceeds 10% of the original blade depth. The Contractor shall: (1) have available at the job site a copy of the manufacturer's design showing the original layout and dimensions of the blades, or (2) place permanent marks on each blade to show points of 10% wear from new conditions.

When the truck mixer carries flush water for cleaning the mixer, it shall be carried in a compartment separate from the mixing water, and each compartment shall be equipped with a calibrated sight gauge.

- C. Mobile Mixers.** The mixer shall be self-propelled and carry sufficient unmixed materials for the concrete.

The maximum cubic yard capacity shall be as certified by the manufacturer on the rating plate attached to the truck mixer.

The mixer shall be capable of positive measurement of cement and flow of water being introduced into the mix. A visible cement recording meter shall be provided and equipped with a ticket printout showing the quantity used. Water flow shall be indicated by flow meter and be readily adjustable to provide for minor variations in aggregate moisture.

The mixer will be calibrated by the Department to ensure that it is capable of automatically proportioning and blending all components on a continuous or intermittent basis, as required by the finishing operation. The Contractor shall furnish a platform scale of 500-pound capacity, 300 pounds of test weights, a container that can be placed on the scale, and a deflector to divert the material from the mixer into the container. Each individual component (aggregate, sand, water, cement, and admixture), shall be calibrated individually and as a component.

The total production capacity of the mixer or mixers shall be adequate to furnish concrete at a rate which permits uninterrupted placement and finishing operations.

The mixer shall be cleaned at suitable intervals, and accumulations of hardened concrete shall be removed.

153.03 CONCRETE TRANSPORTING EQUIPMENT.

- A. **General.** Any equipment used to transport freshly mixed concrete shall deliver the concrete in a thoroughly mixed and uniform mass, meeting all requirements for slump, air content, and uniformity when discharged at the site. The equipment shall have gates or other approved means for controlling the discharge rate as well as vibrators to aid in the discharge.

Equipment used for concrete placement, such as truck boxes, chutes, pipes, buckets, shovels, or wheelbarrows shall not contain aluminum.

- B. **Agitators.** Agitating equipment shall be of the revolving-drum or open-top revolving-blade types, or may be a truck mixer operated at agitating speed. The agitating speed of the revolving drum or blades shall be not less than 2 nor more than 6 revolutions per minute. The body or drum shall be a smooth, watertight, metal container. The maximum cubic yard hauling capacity shall be shown on a rating plate attached to each unit.

153.04 SIDE FORMS.

Straight side forms shall be made of a metal of not less than 7/32 inches thick and not less than 10 feet long. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Form design shall be acceptable to the Engineer; and the forms shall have adequate devices for secure setting so that when in place they withstand, without spring or settlement, the weight impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than 2/3 the height of the form. Forms with battered top surfaces, and forms that are bent, twisted, or broken shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built-up forms shall not be used. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet and the upstanding leg shall not vary from a true plane more than 1/4 inch in 10 feet. The forms shall contain provisions for locking the ends of abutting form sections together tightly and for secure setting. Forms shall be cleaned and oiled before use. Forms of other approved section and material may be used when it is not required that the forms support mechanical fine grading or paving equipment.

153.05 SLIP FORM PAVING EQUIPMENT.

All equipment shall be self-propelled; and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement true to grade and cross section in one complete pass without the use of fixed side forms. No external tractive force shall be applied to the machine. The paver shall vibrate or tamp the concrete for the full width and depth of the layer being placed.

153.06 ROADBED PLANERS.

The roadbed planer shall be constructed of steel and shall be mounted on tracks. The planner shall be heavy enough to trim the roadbed to the specified tolerance with a frame capable of maintaining the required crown under all operating conditions.

The planer shall be equipped with rotary cutting mechanisms capable of trimming the subgrade and base to the required lines and grades within the tolerances of section

302.04 G.2 Surface tolerance Type B. The equipment shall be capable of trimming in sufficient width in one pass to allow the placement of the 28 foot concrete slab.

The planer shall be equipped with automatic grade control that maintains the proper elevation at both sides of the paver by: (1) controlling the elevation of one side and the crown, or (2) controlling the elevation of each side independently. The grade reference shall be an erected string line or other approved method.

The string line control shall consist of a tightly stretched wire or string, offset from and parallel to the pavement edge on one or both sides, and set parallel to the established grade for the pavement surface. The line shall be supported at intervals required to maintain the established grade and alignment.

153.07 CONCRETE SPREADERS.

The spreader shall be self-propelled and capable of spreading the concrete mix to the desired cross sections. The spreader shall be easily adjustable to spread different thicknesses of concrete.

153.08 VIBRATORS.

Vibrators for full width vibration of concrete paving slabs may be either the surface-pan type or the internal-spud type with either immersed tube or multiple spuds. The vibrators may be attached to the spreader or the finishing machine, or may be mounted on a separate carriage. They shall not come in contact with the joint, load transfer devices, subgrade, or side forms. The frequency of the vibrators shall meet the manufacturer's recommendation.

The Contractor shall have available, for the Engineer's use, the proper equipment for determining the frequency of the impulses of the vibrators.

153.09 CONCRETE FINISHING MACHINES.

All concrete finishing machines shall meet the following requirements:

- A. **Transverse Finishing Machines for P.C.C. Pavement.** Each transverse finishing machine shall be self-propelled and be fully and accurately adjustable to produce the specified crowned or flat surface as required.

The finishing machine shall be sufficiently powered, geared, and operated to strike off, screed, and consolidate the concrete consistently, regularly, and smoothly to specified tolerances.

- B. **Bridge Deck Finishing Machines.** A self-propelled finishing machine shall be used to strike off and finish the concrete after it has been placed and consolidated. The finishing machine shall be mounted on wheels which ride on a track and have one or more power-driven oscillating or rotating screeds.

The finishing machine shall be adjustable to the specified crown and elevation to maintain the required concrete cover over the reinforcing steel. The finishing machine shall be wide enough to finish the deck in one pass.

- C. **Finishing Machines for Bridge Deck Overlays.** The finishing machine shall have a mechanical strike off to provide a uniform thickness of concrete in front of

an oscillating screed or screeds. The screed shall be long enough to uniformly strike off and consolidate the width of the lane to be paved. The finishing machine shall be capable of forward and reverse motion under positive control.

At least one oscillating screed shall be capable of consolidating the concrete to the specified density. Each screed shall have an effective weight of at least 75 pounds for each square foot of bottom face area. Each screed shall be provided with positive control of vertical position, the angle of tilt, and the shape of the crown.

Rails, with fully-adjustable supports (not shimmed), shall be required for the finishing machine to travel on, and shall be placed outside the area to be paved.

Rail anchorage shall provide horizontal and vertical stability and the anchors shall not be attached to concrete by use of powder actuated fasteners unless that concrete is to be subsequently overlaid.

153.10 HAND FINISHING EQUIPMENT.

- A. **Screeds.** The manually operated screed shall be of metal construction or metal shod shaped to the designated crown of the pavement, with sufficient rigidity to maintain that crown under working conditions. The screed shall be at least 2 feet longer than the maximum width of slab to be screeded. Unless the concrete is satisfactorily consolidated by vibration before screeding, the screed shall be equipped with an approved vibratory unit.

Manually operated screeds will be allowed only on driveways, concrete tapers, sidewalks, and concrete pavement repair of less than 20 feet in length.

- B. **Straightedges.** The straightedge shall be 10 feet long with an accurate, rigid contact edge designed to test the surface trueness of the pavement, to cut or fill minor surface irregularities, and to remove excess water or laitance from the surface of the pavement. The contact edge shall be periodically tested and adjusted as necessary to assure that the edge has no deviation from a true plane. The straightedge shall be rigidly mounted on a handle of sufficient length to permit its operation over not less than 1/2 the width of the slab from a position outside the forms.

153.11 SPRAYERS FOR LIQUID CURING COMPOUND.

When the pavement is cured by a liquid membrane-forming compound, the compound shall be applied by a self-powered machine with a mechanical-pressure distribution system designed to provide uniform and specified coverage of the pavement. The spray nozzles shall be enclosed by a hood to minimize loss of curing compound during windy conditions. An approved hand-operated sprayer may be used when liquid curing compound is applied to the sides of the pavement slab or to areas of pavement where work dimensions or other features make using a self-powered sprayer impractical.

153.12 CONCRETE SAWS.

Saws shall be adequately powered and furnished with suitable blades to effectively cut pavement joints to required dimensions. Each blade of multiple-blade saws shall be maintained in accurate alignment to the other blades. A device shall be provided to

guide the saw along the required joint alignment. Manual guidance of the saw will be permitted if specified results are obtained. A sufficient number of sawing units shall be available to maintain required progress and provide prompt replacement in case of breakdown. Adequate artificial lighting shall be provided for night sawing.

153.13 JOINT AND CRACK CLEANING AND SEALING EQUIPMENT.

A. General. Joints shall be sawed with a diamond blade saw meeting Section 153.12.

Air compressors shall be equipped with traps for removing all free water and oil from the compressed air and furnish air in excess of 90 psi.

B. Hot Poured Joint Sealant. The heating kettle shall be of the indirect heating, double-boiler type, using oil or other suitable material as the heat transfer medium. The kettle shall have a thermostatically controlled heat source, accurate temperature indicating devices, and an effective mechanical agitator.

The pressure-type applicator shall completely fill the joint from the bottom up to the required height, without overflow or spillage of sealing compound onto the pavement surface.

C. Silicone Sealant. The mechanical device for applying silicone sealant shall be suitable for the intended use, and shall be equipped with a nozzle or spout shaped to fit into the joint for introducing sealer from the bottom up.

153.14 PREFORMED ELASTOMERIC COMPRESSION JOINT SEAL EQUIPMENT.

Prefomed elastomeric compression joint seal shall be installed with a mechanical device as recommended by the seal manufacturer.

153.15 GRINDING MACHINE.

Grinding shall be performed with a device specifically designed for concrete pavement grinding. The machine shall be a power-operated mechanical grinder equipped with diamond blades and capable of uniformly grinding or removing the old surface to depths required without damaging the underlying concrete.

153.16 HYDRODEMOLITION EQUIPMENT.

Hydrodemolition equipment shall consist of a water filtering and pumping unit operating in conjunction with a remotely controlled robotic water jet unit.

The equipment shall remove sound and unsound concrete to the specified depth and shall remove rust and concrete particles from exposed reinforcing bars with high velocity water jets acting under continuous automatic control.

The equipment shall be calibrated by adjusting water pressure, robot speed, and jet oscillation speed so the required level of removal can be achieved.

All water used in hydrodemolition equipment shall be potable. Stream or lake water shall not be used.

**SECTION 200
EARTHWORK**

**SECTION 201
CLEARING AND GRUBBING**

- 201.01 DESCRIPTION
- 201.02 CONSTRUCTION REQUIREMENTS
 - A. General
 - B. Clearing and Grubbing
 - C. Topsoil Removal
- 201.03 METHOD OF MEASUREMENT
- 201.04 BASIS OF PAYMENT

**SECTION 202
REMOVAL OF STRUCTURES, OBSTRUCTIONS,
SURFACING, AND MISCELLANEOUS ITEMS**

- 202.01 DESCRIPTION
- 202.02 CONSTRUCTION REQUIREMENTS
 - A. General
 - B. Removal of Bridges and Box Culverts
 - C. Removal of Pipe Culverts
 - D. Removal of Pavement, Sidewalks, Curbs, etc.
- 202.03 METHOD OF MEASUREMENT
- 202.04 BASIS OF PAYMENT

**SECTION 203
EXCAVATION AND EMBANKMENT**

- 203.01 DESCRIPTION
 - A. Common Excavation
 - B. Rock Excavation
 - C. Shale Excavation
 - D. Muck Excavation
 - E. Borrow
 - F. Unclassified Excavation
- 203.02 CONSTRUCTION REQUIREMENTS
 - A. General
 - B. Salvaging, Stockpiling, and Spreading Topsoil
 - C. Subcut, Scarify, and Recompact Roadbed
 - D. Disposal of Surplus and Unsuitable Material
 - E. Borrow
 - F. Embankment Construction
 - G. Construction of Embankment and Treatment of Cut Areas with Compaction Control, Type A
 - H. Construction of Embankment and Treatment of Cut Areas with Compaction Control, Type B

- I. Construction of Type C Embankment
 - J. Haul
 - K. Finishing
 - L. Provision for Traffic Maintenance
- 203.03 METHOD OF MEASUREMENT
- 203.04 BASIS OF PAYMENT

SECTION 210
STRUCTURAL EXCAVATION, STRUCTURAL FILL,
AND FOUNDATION PREPARATION

- 210.01 DESCRIPTION
- 210.02 MATERIALS
- A. Ordinary Backfill
 - B. Structural Fill
 - 1. Select Backfill
 - 2. Foundation Fill
- 210.03 CONSTRUCTION REQUIREMENTS
- 210.04 METHOD OF MEASUREMENT
- 210.05 BASIS OF PAYMENT

SECTION 216
WATER

- 216.01 DESCRIPTION
- 216.02 MATERIALS
- 216.03 EQUIPMENT
- 216.04 CONSTRUCTION REQUIREMENTS
- 216.05 METHOD OF MEASUREMENT
- 216.06 BASIS OF PAYMENT

SECTION 230
RESHAPING ROADWAY AND SUBGRADE PREPARATION

- 230.01 DESCRIPTION
- 230.02 CONSTRUCTION REQUIREMENTS
- A. Reshaping Roadway, Shoulders, and Inslopes
 - 1. Reshaping Roadway
 - 2. Shoulder Preparation
 - 3. Reshaping Inslopes
 - 4. Topsoil

- B. Subgrade Preparation
 - 1. General Requirements
 - 2. Subgrade Preparation Type A
 - 3. Subgrade Preparation Type B
 - 4. Subgrade Preparation Type A (Shoulders)
 - 5. Subgrade Preparation Type C
 - 6. Aggregate for Subgrade Repair

230.03 METHOD OF MEASUREMENT

230.04 BASIS OF PAYMENT

SECTION 234 STABILIZED SUBGRADE

234.01 DESCRIPTION

234.02 MATERIALS

234.03 EQUIPMENT

234.04 CONSTRUCTION REQUIREMENTS

- A. Spreading
- B. Mixing
- C. Compacting and Finishing
- D. Curing

234.05 METHOD OF MEASUREMENT

234.06 BASIS OF PAYMENT

SECTION 201 CLEARING AND GRUBBING

201.01 DESCRIPTION.

This work consists of clearing, grubbing, removing, and disposing of all vegetation and debris within designated limits of the Right of Way and Easement area. Vegetation and objects designated to remain shall be preserved from damage or defacement.

201.02 CONSTRUCTION REQUIREMENTS.

- A. **General.** The Engineer will establish Right of Way and construction lines and designate all trees, shrubs, plants, and other items to remain. If trees or shrubs selected for retention are cut or scarred during construction activities, any loose bark shall be removed and broken branches shall be pruned.
- B. **Clearing and Grubbing.** Clearing and Grubbing includes the removal and disposal of trees, shrubs, stumps, roots, brush, and other surface objects from the excavation and embankment areas.

Trees located within the boundaries of the new grade shall be removed to a depth of 18 inches below the finished ground line or 3 feet below the final dirt grade, whichever is lower. Trees located outside the boundaries of the new grade shall be removed to a depth of 18 inches below the finished ground line. Existing stumps shall be removed to the same depth specified for tree removal.

Except in areas to be excavated, all cavities resulting from the removal of obstructions shall be backfilled and compacted with suitable material. Compaction shall be obtained by the passage of construction equipment over the backfill.

Perishable material may be burned if burning is permitted by, and done under applicable laws and ordinances. Burning shall be done under the care of competent watchpersons at such times and in a manner that does not jeopardize surrounding vegetation and adjacent property.

Materials and debris may be disposed of at locations off, and out of view of, the Project. Suitable disposal locations shall be obtained from property owners and the cost shall be included in the unit price bid for Clearing and Grubbing. A copy of the written agreement with the property owner shall be furnished to the Engineer. Disposal will not be allowed in wetlands areas.

When permitted by the Engineer, dense perishable material such as logs or tree trunks may be buried at acceptable locations on the right of way outside of construction limits. The material shall be buried to a depth which allows at least two feet of cover material.

All salable timber in the clearing area shall become the Contractor's property.

Low hanging, unsound, and unsightly branches on remaining trees or shrubs shall be removed. Tree branches extending over the roadbed shall be trimmed to give a clear height of 20 feet, or according to local ordinances. All trimming shall be done using good tree surgery practices.

- C. **Topsoil Removal.** Removing, salvaging, stockpiling, and spreading of topsoil shall be as specified in Section 203.02 B.

201.03 METHOD OF MEASUREMENT.

Measurement will be by one or more of the following alternate methods:

- A. **Area Basis.** Measurement will be by the number of acres and fractions of acres acceptably cleared and grubbed within the limits shown on the Plans or staked by the Engineer. Areas not shown on the Plans, or not staked for Clearing and Grubbing, will not be measured for payment.

- B. **Lump Sum Basis.** When the bid schedule contains a Clearing and Grubbing Lump Sum item, no measurement of area will be made.

When the removal and disposal of trees, shrubs, stumps, roots, brush, etc., in excavation and embankment areas is not specified on an individual unit basis, removal and disposal will be included in the Lump Sum price bid for Clearing and Grubbing.

- C. **Linear Basis.** When the linear unit quantity is shown on the bid schedule, the length will be measured along the construction centerline in Stations or Miles.

- D. **Individual Unit Basis.**

1. The diameter of trees shall be measured at a height of 24 inches above the ground. Payment for Stump Removal shall only be made for removing existing stumps. Stumps shall be measured by the average diameter of the stump at ground level. Trees or stumps 8 inches or less in diameter are classified as brush.
2. When the bid schedule indicates measurement of trees and stumps by individual unit basis, they will be designated and measured according to the following schedule of sizes:

Diameter at Height of 24 inches	Pay Item Designation
Over 8 inches to 12 inches	10-inch size each
Over 12 inches to 24 inches	18-inch size each
Over 24 inches	30-inch size each

201.04 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Item	Pay Unit
Clearing and Grubbing	Acre, Stations, Miles, Lump Sum
Tree Removal	Each
Stump Removal	Each

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

Exclusions. When the Bid Schedule does not contain an estimated quantity or a Lump Sum item for Clearing and Grubbing, the work will not be paid for directly but will be included in other Contract items.

SECTION 202 REMOVAL OF STRUCTURES, OBSTRUCTIONS, SURFACING, AND MISCELLANEOUS ITEMS

202.01 DESCRIPTION.

This work consists of razing, removing, salvaging, and disposing of all buildings, foundations, fences, structures, abandoned pipelines, culverts, pavements, manholes, inlets, sidewalks, driveways, curb and gutter, and other obstructions or items on the right of way or easement areas which are not designated or permitted to remain. It shall include salvaging designated materials, and backfilling resulting cavities. Material shall not be disposed of in wetlands areas. Proper disposal of inert waste is covered in Section 107.10.

202.02 CONSTRUCTION REQUIREMENTS.

- A. **General.** All designated salvageable material shall be removed without damage and transported in sections or pieces to specified storage locations. All removed material not designated to be salvaged or disposed of at specified locations, shall become the property of the Contractor and shall be disposed of in a manner satisfactory to the property owners and governing agencies. Copies of all agreements with property owners and governing agencies shall be furnished to the Engineer.

Except in areas to be excavated, basements or cavities left by structure removal shall be backfilled to the level of the surrounding ground. Before backfilling, any remaining concrete slabs shall be broken so that water does not get trapped in the cavity. Cavities located within the area between the toes of the inslopes shall be backfilled and compacted under the same Specifications as the embankment. Cavities located outside these areas shall be compacted to the same level as the surrounding undisturbed ground. There will be no separate payment for excavating or for backfilling and compacting the remaining cavity resulting from the removal of structures and obstructions.

- B. **Removal of Bridges and Box Culverts.** Bridges and box culverts shall not be removed until satisfactory arrangements have been made to accommodate traffic.

Existing substructures shall be removed to the natural stream bottom, and those parts outside of the stream shall be removed one foot below natural ground surface.

Portions of existing structures within the limits of a new structure shall be removed to accommodate the construction of the proposed structure.

Bridges, or portions of bridges, designated as salvaged material, shall be dismantled without damage, match marked, transported and stored at specified locations.

Blasting or other operations necessary to remove an existing structure or obstruction, which may damage new construction, shall be completed before starting the new work.

All concrete removed shall be disposed of under Section 202.02 A.

- C. **Removal of Pipe Culverts.** Pipe culvert designated for salvage shall be removed and stored without breakage or damage. Sections of pipe lost from storage or damaged by negligence shall be replaced at the Contractor's expense. Pipe designated for removal only will not be paid for and shall be removed from view of the project, or disposed of under Section 202.02 A. Pipe designated to be plugged shall be left in place and the ends plugged with compacted earth or concrete. Pipe shall not be removed until satisfactory arrangements have been made to accommodate traffic.
- D. **Removal of Pavement, Sidewalks, Curbs, etc.** All concrete pavement, sidewalks, curbs, gutters, inlets, manholes, driveways, buildings, foundations, slabs, etc., as well as ballast, gravel, bituminous material, or other surfacing or pavement materials not designated for salvage shall be disposed of under Section 202.02 A.

Where portions of an existing structure, pavement, curb, gutter, sidewalk, or similar item are to be left in the surface of the finished work, removal shall be to an existing joint, or sawed to a specified vertical face.

The removal and salvage of bituminous pavement scheduled for use as bituminous surfacing shall be in accordance with Section 405. All material salvaged for reuse as base material shall be removed so the material is not contaminated with dirt or other foreign material. The removal and salvage of P.C.C. pavement for use as recycled P.C.C. pavement shall be in accordance with Section 560.

202.03 METHOD OF MEASUREMENT.

When the Proposal Form stipulates payment will be made for obstruction removal on a Lump Sum basis, the pay item will include all structures and obstructions encountered within the Right of Way and easement areas according to the provisions in this Section. When payment will be made for removal of specific items on a unit basis, measurement will be made by the Lump Sum, Each, Linear Foot, Square Yard, Cubic Yard, or Ton, as stipulated in the Proposal. The sawing of concrete and bituminous surfacing will be measured by the Linear Foot.

202.04 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Items	Pay Unit
Removal of Structures and Obstructions	Lump Sum
Removal of Structure	Each, Lump Sum
Removal of Box Culvert	Each, Lump Sum
Removal of Concrete	Lump Sum, Square Yard, Cubic Yard, Ton
Removal of _____ Surfacing	Square Yard, Cubic Yard, Ton
Removal & Salvage of _____ Surfacing	Square Yard, Cubic Yard, Ton
Removal & Salvage Culverts, All Types & Sizes	Linear Foot
Removal of Curb & Gutter	Linear Foot
Saw Concrete	Linear Foot
Saw Bituminous Surfacing	Linear Foot
Removal of Manholes	Each
Removal of Inlets	Each
Removal of _____	(Any of Above)

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

Exclusions. When the Bid Schedule does not contain an estimated quantity or a Lump Sum item for "Removal of Structures and Obstructions," and the structure or obstruction is shown on the Plans, the work will not be paid for directly but will be included in other Contract Items. If the structure or obstruction is not shown on the Plans and removal is directed by the Engineer, payment will be made according to Section 104.03 D.

SECTION 203 EXCAVATION AND EMBANKMENT

203.01 DESCRIPTION.

This work consists of excavation, haul, placement and compaction of embankment, and disposal, if necessary, of material encountered within the limits of work necessary for construction of the roadway. Excavation in this Section will be classified as "Common Excavation," "Rock Excavation," "Muck Excavation," "Shale Excavation," or "Borrow" as described below.

- A. **Common Excavation.** Common Excavation consists of all excavation not otherwise classified. If encountered, coal will be measured and paid for as Common Excavation and shall be deposited outside the construction limits at designated locations, or at locations acceptable to the Engineer.

Types of excavation according to compaction control methods shall be as follows:

Type	Section
1. Common Excavation with Compaction Control, Type A	203.02 G
2. Common Excavation with Compaction Control, Type B	203.02 H
3. Common Excavation with Type C Embankment	203.02 I

- B. **Rock Excavation.** Rock Excavation consists of excavating hard solid rock in ledges and bedded deposits which is so hard or firmly cemented that it must be blasted before it can be excavated and removed; or that heavy duty dozer-mounted rippers or dozer blades must be used to break the material into chunks. Material that breaks or shatters into pieces of less than one cubic foot in size during breaking operations (excluding blasting) will be classified as shale.

Rock excavation includes all boulders and other detached rock having a volume of 1/2 cubic yard or more.

If no bid item is provided for Rock Excavation, and rock is encountered which must be blasted or ripped as described above, the material will be paid for as shown in the Price Schedule PS-1.

- C. **Shale Excavation.** Shale excavation includes the excavating of shale material consisting of laminated, fissile, sedimentary material composed principally of fine grained particles. The Contractor must demonstrate to the Engineer that the material is shale and cannot be removed by conventional scrapers and dozers and must be ripped by use of heavy-duty rippers of a type normally rear-mounted on dozers or similar equipment. If the material can be ripped using a motor grader equipped with ripper/scarifying teeth, it will be paid for as Common Excavation.

When shale is a bid item, Section 104.04 will not apply. If no bid item is provided, and shale is encountered which has to be ripped before removal, as described above, the material will be paid for as shown in the Price Schedule PS-1.

- D. **Muck Excavation.** Muck Excavation consists of the removal and disposal of deposits of saturated or unsaturated mixtures of soils and organic matter unsuitable for use as embankment material; and cannot be removed by use of conventional scrapers and dozers, but must be removed by equipment such as draglines, shovels, excavators which operate outside the area being excavated.

If no bid item is provided for Muck Excavation, and muck is encountered which requires removal as described above, the material will be paid for as shown in the Price Schedule PS-1.

- E. **Borrow.** Borrow consists of excavation, haul, placement, and compaction of embankment material obtained from locations outside the Right of Way. The borrow areas may be either Department-optional or Contractor-furnished, as shown in the Contract or as approved by the Engineer.

- F. **Unclassified Excavation.** Unclassified excavation consists of the removal and disposal of all materials of whatever character encountered in the work.

203.02 CONSTRUCTION REQUIREMENTS.

- A. **General.** The excavation and embankments shall be finished to smooth and uniform surfaces. No excess material shall be disposed of without permission of the

Engineer. Excavation operations shall be conducted without disturbing material outside the slope limits. Before beginning excavation, grading, and embankment operations, all necessary clearing and grubbing in the area shall have been performed according to Section 201.

Borrow material should not be placed until all roadway excavation has been placed in the embankment. If more borrow is placed than is required and causes a waste of excavation, the quantity of waste will be deducted from the volume measured in the borrow area. If more embankment is placed than is required, the excess embankment quantity will be deducted from the volume of borrow or excavation measured for payment.

1. **Rock Subcut.** Material classified as rock shall be excavated to a minimum depth of 6 inches and a maximum depth of 12 inches below subgrade within the limits of the roadbed. The excavation shall be backfilled with material designated on the Plans or approved by the Engineer. Undrained pockets shall not be left in the rock surface. Rock removed in excess of 12 inches below subgrade will not be measured or paid for.

Rock excavation backfill in excess of 12 inches below the subgrade will be at the Contractor's expense.

2. **Roadway Obliteration.** Limits of obliteration of old roadways will be shown on the Plans. Obliteration includes removal of roadway surface material, structures, and appurtenances, filling in of all ditches, rough grading, placing of topsoil, and seeding. The original ground contour shall be restored to present an appearance of natural rounded slopes.
3. **Historical Preservation.** When the remains of prehistoric dwelling sites or artifacts of historical or archaeological significance are encountered within the Right of Way, easement areas, or within Department optioned borrow areas, the Contractor shall immediately cease operations at that location and shall meet the provisions of Section 107.04 A.

Before removal of topsoil or other material from a Contractor furnished borrow area, the Contractor shall meet the provisions of Section 107.04 B and initiate appropriate action at least 14 days before disturbing the borrow area.

4. **Unsuitable Material.** Unsuitable material encountered in the subgrade shall be removed to the depth directed and disposed of under Section 203.02 D. Construction operations shall be conducted so necessary measurements can be taken before replacing unsuitable material with satisfactory backfill.
5. **Second Handling.** When excavation which requires more than one handling before final placement due to circumstances beyond the Contractor's control, the second handling will be paid as agreed upon before the work by:
 - a. A negotiated price.
 - b. Extra Work according to Section 104.03 D.

- B. **Salvaging, Stockpiling, and Spreading Topsoil.** Topsoil shall be removed from all excavation and embankment areas, and stockpiled on the Right of Way at

designated or acceptable locations outside the grading limits. Additional areas outside the Right of Way required to stockpile topsoil shall be obtained by and at the Contractor's expense. Topsoil shall be removed to its full depth, but not to exceed 6 inches. The equipment and methods shall be adjusted to avoid the removal of subsoil or other unsuitable material. Hauling of topsoil shall not exceed the Plan haul limits. All stockpiled topsoil shall be spread evenly over the entire area of the new roadway except the roadbed.

- C. **Subcut, Scarify, and Recompact Roadbed.** In areas designated to be subcut, the roadbed shall be excavated and removed below the proposed grade line within the horizontal and vertical limits shown on the Plans. The next one foot in depth shall be scarified and recompact.

Subcut sections shall be backfilled and compacted with material approved by the Engineer. Subcut will be paid as Common Excavation material.

In cut sections not designated to be subcut, the roadbed shall be scarified and recompact to a depth of one foot. All scarifying and recompact shall be included in the price bid for Common Excavation.

All material, whether scarified or backfilled, shall be recompact with the same type of moisture and density controls as specified for the embankment construction.

- D. **Disposal of Surplus and Unsuitable Material.** Excavated materials classed as waste or unsuitable shall be disposed of at sites selected by the Contractor and acceptable to the Engineer. All rocks and boulders shall be buried under at least one foot of earth. All suitable surplus material shall be used to uniformly widen embankments and flatten slopes within the Right of Way. The Contractor shall obtain and file with the Department, a copy of the written permission from the Landowner for disposal sites outside of the Right of Way. Waste or unsuitable material shall not be placed in wetlands. Payment will be made at negotiated prices according to Section 104.03 D.

E. **Borrow.**

1. **General.** Borrow material shall not be excavated beyond the dimensions and elevations established, or before staking and cross sectioning the site.

Topsoil, as shown in the Contract Documents, shall be removed and stockpiled before excavation of borrow material. The Contractor shall provide at least 2 working days notice to the Engineer to complete the necessary preliminary cross sectioning before removal of topsoil. An additional one working day notice shall be given before excavating borrow so topsoil measurements can be completed.

After excavation is complete, the borrow area shall be reshaped to insure accurate final cross sectioning of the borrow area and provide adequate drainage. Excavated slopes shall not be steeper than 8:1 except where blending into existing steeper slopes. Cartways shall be obliterated, reshaped, and all disturbed areas reseeded to meet the condition of the adjacent ground surfaces. The costs of obliterating, scarifying, reshaping, and reseeded of the cartways shall be incidental to the price bid for "Borrow."

Work shall be scheduled in all borrow areas to allow any utility company to relocate, adjust, or remove their facilities.

Borrow material shall not be removed within 5 feet of any buried facility, within 10 feet of any utility pole, or within 25 feet of any utility structure until the utility has been relocated, removed, or adjusted. The slopes around utilities shall not be steeper than 3:1.

After relocation, removal, or adjustment of the utility, all remaining material shall be removed to match the final adjacent elevations. The Contractor's operations shall be coordinated with the utility companies.

The Department will be responsible for utilities relocations and costs of relocations in Department-optioned borrow areas. The Contractor shall be responsible for any utility adjustment work in Contractor-furnished borrow areas.

Fencing removed to facilitate borrow operations shall be replaced to its original condition to the satisfaction of the landowner. The Contractor shall be responsible for confinement of livestock when fencing is removed or altered.

2. **Department-Optioned Borrow.** The Department may acquire an option and may assign the right to take materials from the sources described in the proposal. The Contractor shall notify the landowner in writing that the Contractor is exercising the Department's option to purchase materials under the terms and conditions provided in the option and any other terms and conditions which might be negotiated and agreed to between the Contractor and the landowner. A copy of the written notification to exercise the Department's option, and any other agreement negotiated between the Contractor and the landowner regarding use of Department optioned pits, must be provided to the Engineer approximately 10 days before moving into a Department-optioned borrow area. The written notification to the landowner shall inform the property owner or agent of the removal plan and use of the cartway.

All Department-optioned borrow area data listed in the Proposal is preliminary borrow area information. Contractors are responsible for checking all listed borrow area information before bidding.

Information issued for Department-optioned borrow areas is for use by all Bidders on an equal competitive basis.

The Contractor shall verify from County records and furnish to the Engineer in writing the name(s) of the legal owner(s) of the borrow area during the time the borrow material was removed. The names of any other parties having a legal interest in the property shall be included in the written statement.

If the borrow area is not used after notifying the Department and landowner of the expected borrow area entry, the Contractor is liable for crop damage. If the borrow area is used, the Department is liable for crop damage. Crop damage will be paid according to the predetermined amount stated in the Proposal Form.

The removal, stockpiling, and spreading of topsoil shall be as specified in Section 203.02 B. Seeding shall be according to Section 708.02.

After the borrow area has been restored to a satisfactory condition, the Contractor shall obtain a release from the landowner or the landowner's authorized

agent. The Contractor shall make the royalty payment to the landowner, including other parties with legal interest in the property, and shall obtain a receipt of payment. Cost of royalties shall be included in the price bid for borrow. A copy of the release and receipt of payment shall be furnished to the Department.

After the Contractor has removed the minimum quantity of borrow estimated in the borrow option, the Contractor shall pay the landowner and any other parties with legal interest in the property 80% of the minimum payment within 30 days after the Department has made payment to the Contractor. The balance of the royalty payment shall be paid within 30 days after the Department supplies the Contractor with final quantities. Should the work be performed in more than one calendar year, payment for material removed from the optioned area during a calendar year shall become due on December 31 of that year. If a different payment arrangement is negotiated between the Contractor and the landowner, a copy of the agreement shall be filed with the Department.

If a material shortage or other problems occur in the Department-optioned area, and the Contractor is directed to furnish borrow from an alternate site, payment for topsoil and seeding will be made on the basis shown for the Department-optioned area. The Contractor will be reimbursed for any costs or hauls in excess of what would be incurred in the Department-optioned area. Measurement for added haul will be according to Section 203.03 E.

3. **Contractor-Furnished Borrow.** Unless the Department-optioned borrow areas listed in the Proposal Form are mandatory, the Contractor may obtain the borrow from another source. If no Department-optioned borrow is listed in the Proposal Form, the Contractor shall obtain a suitable borrow source. The Engineer will determine if the material from another source is suitable for the specified use.

The Contractor shall make arrangements for obtaining suitable borrow and shall bear all costs of obtaining, opening, and restoring the site.

In either circumstance, the Contractor's costs shall include but shall not be restricted to, royalty payments, removal and replacement of topsoil, reshaping and scarifying, obliterating cartways, crop damage, seeding, and any overhaul. After the borrow area has been restored to satisfactory condition, the Contractor shall obtain a release and receipt of payment from the landowner and furnish copies to the Department.

- F. **Embankment Construction.** Embankment construction includes preparation of areas upon which embankments are to be placed; construction of dikes inside or outside the Right of Way; placement and compaction of material in areas where unsuitable material has been removed; and placement and compaction of embankment material in holes, pits, and other depressions within the roadway area. Only approved materials shall be used in the construction of embankments and backfills.

Rocks, broken concrete, or other solid materials shall not be placed in embankment areas where piling is to be placed or driven. Rocks larger than 4 inches in its longest dimension shall not be placed in the top one foot of the finished grade.

Benching shall be required whenever embankment is placed against slopes steeper than 4:1. Benching shall be of sufficient width to permit operations of placing and compacting equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Excavated material shall be recompacted along with new embankment material, and the cost for benching and recompacting shall be incidental to the price bid for other items.

Whenever the finished subgrade lies within 3 feet of an existing compacted roadway with an aggregate or bituminous surface, the bituminous material shall be removed and the remaining road surface shall be scarified to a depth of at least 6 inches and recompacted to the specified density. The bituminous material shall be disposed of according to Section 203.02 D.

If embankment can only be placed on one side of abutments, wing walls, piers, or culvert headwalls, compaction operations shall be accomplished without placing excessive pressure against the structure. The fill adjacent to the bridge abutment shall not be placed higher than the berm elevation in front of the abutment until the superstructure is in place. When embankment is placed on both sides of a concrete wall or box-type structure, the embankment shall be brought up equally on both sides of the structure.

If the Engineer directs that material to be used in embankment be hauled beyond the average haul limit, it will be measured according to Section 203.03 E and paid as specified in the Price Schedule (PS-1).

Frozen material shall not be used in embankment construction. If frozen excavation or a blanket of snow is encountered, grading operations shall be suspended.

Roadway embankments of earth material shall be placed in horizontal layers not to exceed 12 inches (loose measurement), and shall be compacted to the specified density before the next layer is placed.

Motor graders shall be used on each lift to spread the material and to obtain uniform thickness before compacting. As the compaction of each layer progresses, continuous leveling, diskings, and manipulating shall be provided to assure uniform soil distribution, moisture, and density control. Construction equipment shall be routed uniformly over the entire surface of each layer; and, if open to traffic, the embankment shall be maintained so that the traveling public can safely traverse the work area.

When the excavated material consists predominantly of rock too large to be placed in layers of the thickness prescribed, the material may be placed in thicknesses up to the average rock size, but no thicker than 2 feet. Each layer shall be leveled and smoothed by using suitable leveling equipment and by distributing the fine fragments. The rock fill lifts shall not be constructed above an elevation of 2 feet below the finished subgrade. The balance of the embankment shall be composed of suitable earth placed according to this Section.

When a rock fill is to be placed over any structure, the structure shall first be covered and compacted with a minimum of 2 feet of earth or other approved material before placing rock fill.

- G. Construction of Embankment and Treatment of Cut Areas With Compaction Control, Type A.** All embankments and cut areas, except for rock fills, shall be constructed with moisture and density controls. The requirements of Section 203.02 F also apply to this section.

The Engineer will determine the maximum dry density and optimum moisture content using AASHTO T-99 or T-180 as shown on the Plans. Both AASHTO T-99 or T-180 may be modified according to the Department's testing procedure.

When the maximum dry density is determined using AASHTO T-99, the moisture content of the soil at the time of compaction shall be not less than 4 percentage points below, nor more than 5 percentage points above the optimum moisture content. The embankment and cut areas designated to be excavated and recompacted shall be compacted to 95% of the maximum dry density as determined by AASHTO T-99.

When the maximum dry density is determined using AASHTO T-180, the moisture content of the soil at the time of compaction shall be not less than the optimum moisture content and no more than 5 percentage points above the optimum moisture. The embankment and the cut areas designated to be excavated and recompacted shall be compacted to 85% of the maximum dry density as determined by AASHTO T-180.

If the subgrade is unstable (as evidenced by sponginess or rutting) when compacted to the required density, the soil shall be dried to obtain adequate stability. This may require drying below optimum moisture. The cost of such drying will be incidental to the price bid for Common Excavation and Borrow. The soil shall be worked so that the moisture content is uniform throughout.

Private drives, minor road approaches, and other parts of the embankment outside the roadbed shall be compacted as directed by the Engineer.

In the construction of a surcharge, no specified density is required.

- H. Construction of Embankment and Treatment of Cut Areas with Compaction Control, Type B.** Except for rock fills and the first layer of fills over swampy ground, embankment materials shall be deposited in layers not exceeding 12 inches in thickness before compaction. The requirements of Section 203.02 F also apply to this section.

Each layer shall be uniformly compacted by operating grading equipment and rollers over the entire area. Tamping rollers shall be operated over each layer until the Engineer is satisfied with the depth of penetration of the tamping feet. The compaction of each layer of embankment material shall be thorough and uniform. The tamping feet of tamping rollers shall exert a ground pressure of at least 250 psi.

If the Engineer determines that the soil is too dry to secure compaction, water shall be applied to each layer before compacting.

Embankment material that is too wet to secure compaction and stability shall be dried or allowed to dry so the desired compaction can be obtained, and worked so the moisture content is uniform throughout.

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until the specified compaction is secured.

- I. **Construction of Type C Embankment.** Except for rock fills and the first layers of fills over swampy ground, embankment material shall be spread in horizontal layers not exceeding 8 inches in thickness (loose measurement) over the full width of the proposed embankment section. No compaction other than that obtained by passage of the construction equipment over the work is required. The construction equipment shall be routed uniformly over the entire area of each layer. The addition of water or drying of fill material is required when directed by the Engineer. The requirements of Section 203.02 F also apply to this Section.
- J. **Haul.** Haul consists of transporting excavation material from its original location to its final location in the work.
 - 1. Average haul is the average distance in stations which all excavation in excess of that deposited within the station must be hauled.
 - 2. Free-haul distance is the specified distance excavated material shall be hauled without additional compensation. The free-haul distance is defined as the average haul for the Project.
 - 3. Overhaul consists of authorized hauling in excess of the free-haul distance, if the haul is also beyond the designated balance points.

The various items of work under the general heading of Earthwork includes all haul and no allowance will be made for Overhaul, except as follows:

Whenever the quantity of Excavation within balance points or divisions is insufficient to make the required embankment, and no borrow excavation is specified to make up deficiencies, the Engineer may require the Contractor to secure additional excavation outside the balance division within the limits of the Right of Way. Such material will be measured and paid for under the pertinent classifications included in the Contract as set forth under Section 200, and all transportation and haul on such material in excess of the average haul for the Project will be classed as Overhaul.

- K. **Finishing.** Excavation and embankment work, including borrow areas, shall be finished true to grade and cross section. The backslopes and ditches shall be kept finished as construction progresses.

The Contractor shall conduct operations so the distance between the point where the old road surface is disturbed or excavation begins, to where the roadbed is finished to grade and aggregate is placed does not exceed 3 miles for each active grading operation. Provisions for the safety and convenience of the traveling public shall be made on roads kept open to traffic.

- L. **Provision for Traffic Maintenance.** Temporary stockpiles of traffic service gravel shall be placed where specified or as directed by the Engineer. These stockpiles shall be used to provide a temporary surface to aid traffic flow through construction areas during wet and muddy conditions and during other periods when construction operations are suspended. Grading operations on the existing roadbed shall not be started until the temporary traffic service gravel stockpiles are complete.

Stockpiled traffic service gravel that is not needed for traffic maintenance shall be used as follows:

1. If all the material is the same class of aggregate as specified for the base, it shall be incorporated into the final aggregate course placed on the subgrade.
2. If the material is not the same class of aggregate as specified for the base, it shall be incorporated into the subgrade as directed by the Engineer.

203.03 METHOD OF MEASUREMENT.

- A. **Measured Quantities.** All accepted excavation and borrow shall be measured in its original position by cross-sectioning. Volumes will be computed from the cross-section measurements by the average end area, prismatic, or other acceptable methods.

Authorized excavation of rock, shale, muck, or unsuitable material below grade shall consist of that excavation necessary to provide the designed thickness of backfill. If the plane of the designated bottom of excavation falls within a layer or stratum of rock, the rock to the bottom of the layer, not to exceed 12 inches, will be authorized excavation and measured for payment. Rock excavation more than 12 inches below grade will not be paid for unless authorized by the Engineer. The measurements will include overbreakage in rock excavation from the backslopes to an amount not to exceed 10% of the actual quantity.

When unexpected rock excavation or shale is encountered, the Contractor shall notify the Engineer. The Contractor's operations shall be conducted so the rock or shale excavation quantity can be readily measurable. If this is not done, the entire quantity of material will be paid for as Common Excavation.

Unsuitable materials, excavated and removed to obtain proper compaction in cut sections and in foundations for fill sections, will be measured for payment.

Where it is impractical to measure material by the cross section method due to the erratic location of isolated deposits, acceptable methods involving three dimensional measurements may be used.

- B. **Contract Quantity Payment.** When specified on the Plans, the quantities of excavation to be paid will be those shown in the Contract, provided the Project is constructed to the lines and grades shown on the Plans.

When disagreement exists between the Contractor and the Engineer as to the accuracy of the Plan quantities in any balance or the entire Project, either party may request that the quantities be measured. Additional original cross sections may be interpolated at points where necessary to more accurately determine the quantities.

- C. **Borrow.** Borrow will be measured and paid for by the Cubic Yard or Ton according to Section 109.01.
- D. **Water.** When payment for Water is specified, Water used will be measured according to Section 216.05.

When Water is not specified as a pay item in the Contract, Water used will be included in the other items of work.

- E. **Haul.** Authorized haul will be based on depositing the excavated material in the adjacent embankment which is the minimum possible distance. The haul distance for material obtained from the roadway and placed inside the roadway shall be measured along the centerline of the roadway. The haul distance for material moved from outside the roadway shall be measured along the shortest route determined by the Engineer.

1. **Authorized Haul.** Haul will be the product obtained by multiplying the number of units of excavation removed from its original position, by the mean distance such excavation is hauled. The distance between the center of gravity of the excavation and the center of gravity of the embankment will be the haul distance in the units specified.

$$\text{Haul} = \text{Unit of Excavation} \times \text{Mean Haul Distance}$$

2. **Average Haul.** The average haul will be determined from the mass diagram. The area of the mass diagram representing the number of cubic yard stations of haul between the balance points will be divided by the ordinate of the mass which is the yardage hauled. The resulting quotient is the average haul.

Average Haul.

$$\text{Average Haul (in Sta.)} = \frac{\text{C.Y. Sta. of Haul}}{\text{C.Y. Hauled}}$$

3. **Overhaul.** The limit of free-haul will be determined from a mass diagram by fixing on the volume curve, 2 points, one on each side of the neutral grade point, one in excavation, and the other in embankment, such that the distance between them equals the free-haul distance, and the included quantity of excavation and embankment are in balance. All materials within the free-haul limit will be eliminated from further consideration. The distance between the center of gravity of the remaining mass of excavation and the remaining mass of embankment minus the free-haul distance, will be the overhaul distance. The quantity of overhaul is the product of the overhaul distance multiplied by the number of units of material hauled in excess of the free-haul distance. Analytical methods may be used for computing overhaul in lieu of the mass diagram method described herein.

The Engineer will determine the necessity for overhaul and shall be afforded 6 hours before and after hauling operations to take the necessary cross sections and measurements to determine the volume of overhaul excavation.

Overhaul: Distances will be shown in stations.

$$\text{Overhaul Distance} = (\text{Distance between centers of gravity}) - (\text{Free Haul Distance}^*)$$

*Free Haul Distance = Average Haul for the Project.

- F. **Obliteration.** Roadway obliteration will be measured in Linear Feet of roadway or in Cubic Yards.

- G. **Topsoil.** Topsoil from excavation, embankment, and borrow areas will be measured by the Cubic Yard. The contract quantity of topsoil may be paid if the Engineer determines that the topsoil within the construction limits has been removed and to the required depth. Any changes in the topsoil removal areas will require measurement.
- H. **Embankment.** Embankment will be measured under Section 203.03 A except the original cross sections will be taken after topsoil is removed from the embankment area. Final cross sections will be taken after the embankment is placed and before the topsoil is replaced.
- I. **Guardrail Embankment, Type C.** Guardrail Embankment, Type C will be measured as a unit at each location, complete and in place.
- J. **Urban Project Provisions.** The back side of curb and gutter is the outer limit for measurement of Common Excavation pay quantity. Where the sidewalk is adjacent to the curb and gutter, the outer limit for measurement of the Common Excavation is the outer edge of the sidewalk.

Costs for the disposal of excess excavation from the trenches of storm drains, water lines, water mains, sanitary sewers, and related items will be included in the price bid for the respective pay item.

Excess excavation and old concrete sidewalks, driveways, curb and gutter, pavement, bituminous surfacing, etc., shall be disposed of off the Right of Way at a site selected by the Contractor and acceptable to the Engineer. Disposal in wetland areas will not be allowed. The cost of disposal (and obtaining of the disposal area) will be included in the price bid for other items.

- K. **Seeding.** Seeding and Topsoil for Type C Seeding will be measured and paid for under Sections 708.02 D and 708.02 E.

203.04 BASIS OF PAYMENT.

When there is no Contract item for rock or shale excavation, they will be paid for at the rate specified in the Proposal Price Schedule (PS-1).

Payment will be made at the Contract Unit Price for the following:

Pay Item	Pay Unit
Common Excavation Type A	Cubic Yard
Common Excavation Type B	Cubic Yard
Common Excavation Type C	Cubic Yard
Topsoil	Cubic Yard
Rock Excavation	Cubic Yard
Muck Excavation	Cubic Yard
Shale Excavation	Cubic Yard
Borrow	Cubic Yard or Ton
Water	M.G. (1,000 Gallons)
Roadway Obliteration	Linear Feet, Cubic Yard
Embankment	Cubic Yard
Guardrail Embankment, Type C	Each
Unclassified Excavation	Cubic Yard

Payment will be made under:

Pay Item	Unit of Quantity	Units of Distance	Pay Units
Overhaul	Cubic Yard	Stations of 100 ft.	Cubic Yard Stations

The item of average haul will not be paid directly, as it is included in the other earth-work items.

Haul items will not be measured and paid if the material can be secured and used as shown on the Plans. If the Engineer directs hauling of materials beyond the specified or average haul limits, haul will be paid at the rate specified in the Price Schedule (PS-1).

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 210 STRUCTURAL EXCAVATION, STRUCTURAL FILL, AND FOUNDATION PREPARATION

210.01 DESCRIPTION.

Structural Excavation consists of the excavation and ordinary backfill required for installation of pipe culverts, conduits, storm drains, box culverts, and bridges.

Structural Fill shall consist of furnishing and placing foundation fill and select backfill material as shown on the Plans or as otherwise directed.

Foundation Preparation consists of site preparation for installation of a box culvert or bridge.

210.02 MATERIALS.

A. **Ordinary Backfill.** Material for ordinary backfill shall be approved compactible soil selected from structure or roadway excavation. Any additional material needed shall be approved material obtained from borrow excavation.

B. **Structural Fill.**

1. **Select Backfill.** Select backfill shall be a well-graded mixture of stone fragments or gravel, coarse sand, and fine sand, excluding scoria and shale. Maximum size and gradation shall be as specified.
2. **Foundation Fill.** Foundation fill material shall be any granular material, other than scoria or shale, with less than 35% passing the No. 200 sieve.

210.03 CONSTRUCTION REQUIREMENTS.

The excavating, shoring, cofferdamming, sealing, and pumping for box culverts and bridges shall be done so the concrete is placed in a dry area free from standing or flowing water.

When a footing is placed on an excavated surface, the bottom of the excavation shall not be disturbed. If disturbed, the area shall be scarified and recompact with a mechanical tamper. Final preparation of the foundation bed shall be made just before concrete placement. When foundation piles are used, the bottom of the excavation may extend below the bottom of the footing to allow for heaving and placing backfill after the piles are driven. This extra excavation and backfill shall be at the Contractor's expense.

All suitable excavated material shall be used for backfilling, and the balance shall be stockpiled or disposed of at locations acceptable to the Engineer. All unsuitable material shall be disposed of and paid for according to Section 203.02 D.

After the unsuitable material has been excavated, foundation fill shall be placed in uniform layers to the required elevation. Each layer shall be thoroughly compacted with mechanical tamping equipment. Water may be required to achieve satisfactory compaction and stability.

Backfill shall not be placed to a higher elevation on one side than on the other side of a wall until the concrete has attained at least 70% of its design strength. If a wall depends on a superstructure for support, backfill shall not be placed until the falsework for the superstructure has been released. Concrete box culverts shall not be backfilled until the concrete has attained at least 70% of its design strength.

A mound of broken rock or coarse sand and gravel, of at least a 1/2 cubic yard, shall be placed at the inlet end of each drain hole in a wing, abutment, culvert wall, or retaining wall. Form boards or other obstructions shall be removed from the drain holes, and the backfill shall be placed to the level of the drain hole inlet before the granular material is in place.

When there are separate structural and grading contracts, the Structural Contractor shall backfill box culverts to an elevation of 2 feet above the top of the box culvert, and shall backfill bridges to the elevation shown on the Plans. The horizontal limits of the backfill shall be as shown on the Plans. The Grading Contractor shall complete the remaining backfill in conjunction with grading operations.

When a specified density is required, backfill shall be placed in horizontal layers not exceeding 12 inches loose measurement and be uniformly compacted with mechanical tamping equipment to the specified density.

In non-load carrying areas where specified density is not required, the backfill shall be placed in layers of not more than 6 inches, moistened or dried as required, and thoroughly compacted with mechanical tamping equipment.

Special care shall be taken to prevent any wedging action against the structure. The use of drop pile hammers, loaded or unloaded clam shells, or other similar equipment is prohibited for compacting backfill.

Backfill material deposited in water or adjacent to piers within the waterway shall be deposited and compacted in a manner acceptable to the Engineer.

Sheet piling, bracing, forms, and rubbish shall be removed from the excavation before the backfill is started.

210.04 METHOD OF MEASUREMENT.

A. **Excavation for Box Culverts and Bridges.** The unit of measure will be either by Cubic Yard or Lump Sum, as specified on the Plans.

1. **Channel Excavation.** All excavation designated on the Plans as channel excavation, including the excavation necessary to place riprap and aggregate cushion, and excavation necessary to flatten and shape the slopes to and beyond the abutment locations.

When Class 1 or Class 2 Excavation is measured and paid for by the Cubic Yard, the volume to be paid for will be that volume bounded by vertical planes located at either 1 1/2 feet outside of the footing, or 2 1/2 feet outside of and parallel to the wall, whichever is greater, and the following:

- a. Class 1 Excavation. All excavation above the datum line and outside the limits of channel excavation, as designated on the Plans.
- b. Class 2 Excavation. All excavation below the datum line and outside the limits of channel excavation, as designated on the Plans.

B. **Foundation Preparation.** The Unit of Measure will be Each for each structural site and, unless specified as separate pay items, will include the cost of performing the following work items:

Clearing and Grubbing
Excavation
Removal of Old Structures (or parts thereof as required)
Construction and Removal of Shoring, Cribs, Cofferdams
Dewatering the Excavation
Concrete Seal
Backfilling
Disposal of Surplus Material

Dewatering consists of removing water as needed to facilitate construction, and may require intermittent or continuous operation of pumping equipment until the affected construction activities in the dewatered area are completed.

C. **Structural Fill.**

1. **Ordinary Backfill.** Ordinary backfill will not be measured, but is incidental to excavation.
2. **Select Backfill.** This item will be measured by the Cubic Yard in place. This measured volume will be increased by 25% to allow for shrinkage and to obtain the pay quantity. When select backfill is placed beyond the excavation

limits, the pay quantity will be determined by computation using plan dimensions and adding 25% for shrinkage.

3. **Foundation Fill.** This item will be measured by the Cubic Yard in place. The measured volume will be increased by 25% to allow for shrinkage and to obtain the pay quantity.

210.05 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Item	Pay Unit
Channel Excavation	Lump Sum, Cubic Yard
Class 1 Excavation	Lump Sum, Cubic Yard
Class 2 Excavation	Lump Sum, Cubic Yard
Foundation Preparation	Each
Foundation Fill	Cubic Yard
Select Backfill	Cubic Yard

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 216 WATER

216.01 DESCRIPTION.

This item consists of applying water to materials being incorporated into construction of items covered by the Contract.

Provisions of this Specification shall not apply to Portland Cement mixing water or for watering seeded or sodded areas.

216.02 MATERIALS.

Water shall be furnished by the Contractor and shall be free of any material which impedes its flow through the spraying device.

216.03 EQUIPMENT.

Equipment shall meet Section 151.03 A. Hauling units shall not exceed their licensed legal weight limits.

216.04 CONSTRUCTION REQUIREMENTS.

Water shall be applied to the embankment, to construction materials on the roadbed, to haul roads, and to plant sites in sufficient quantity to secure and maintain proper moisture content or dust control.

216.05 METHOD OF MEASUREMENT.

Water will be measured in units of “M” Gallons (1,000 gallons). Water may be measured in calibrated tanks, by weighing and converting to gallons at the rate of 8.34 pounds per gallon, or by an approved metering device placed in the supply line. The metering device shall be calibrated before use on the Project.

216.06 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Item	Pay Unit
Water	M. Gallons

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 230

RESHAPING ROADWAY AND SUBGRADE PREPARATION

230.01 DESCRIPTION.

This work consists of scarifying, shaping, compacting, and maintaining the subgrade, or reshaping an existing roadway before constructing a base, or surface course.

230.02 CONSTRUCTION REQUIREMENTS.**A. Reshaping Roadway, Shoulders, and Inslopes.**

1. **Reshaping Roadway.** All sod shall be removed from that portion of the existing roadbed and slopes between the shoulder lines of the completed roadbed. The roadway, ditches, and slopes shall be reshaped to an elevation and cross section that meets the typical section shown on the Plan.

All soft and spongy material, rocks larger than 4 inches, roots and other foreign matter brought to the surface shall be removed and disposed of under Section 203.02 D. All holes and depressions shall be filled and compacted with approved material.

The subgrade shall be smooth, moistened or dried as necessary, and compacted as specified. Any defects in the subgrade shall be corrected according to these Specifications.

2. **Shoulder Preparation.** When included as a separate bid item, “Shoulder Preparation” consists of preparing the existing shoulders to receive a base or

surface course. All weeds, grass, dirt, and other objectionable material shall be removed from the shoulders by blading, power brooms, or other means approved by the Engineer. Sod chunks or pieces of debris larger than 36 square inches on any face shall be disposed of under Section 203.02 D.

3. **Reshaping Inslopes.** When shown as a separate bid item, "Reshaping Inslopes" consists of reshaping existing inslopes to form a smooth transition between the finished shoulder and the existing inslope.
4. **Topsoil.** Topsoil shall be removed from inslopes and other seeded areas where reshaping will take place, and shall be stockpiled on the Right of Way or other locations acceptable to the Engineer. Topsoil shall be replaced according to Section 203.02 B.

On divided highways, topsoil removed from median inslopes shall be stockpiled at locations shown on the Plans or acceptable to the Engineer.

B. Subgrade Preparation.

1. **General Requirements.** The subgrade shall be scarified to a minimum depth of 6 inches, and compacted and shaped to the required section. Soft or spongy areas shall be aerated and recompact or excavated and replaced with suitable backfill. Rocks which interfere with trimming the subgrade, roots, and foreign material brought to the surface, shall be disposed under Section 203.02 D.

If the specified density and stability cannot be obtained by manipulating and drying the top 6 inches of subgrade because of excessive moisture or frost action, work shall be suspended, without additional payment to the Contractor, to allow the subgrade to recover its strength. If the Engineer directs manipulation and drying below the top 6 inches of the subgrade, payment will be made according to Section 104.03 D.

The Contractor shall maintain the subgrade and repair any damage resulting from construction operations or from public traffic. Base or surface material shall not be placed until the subgrade has been checked and approved by the Engineer.

The subgrade shall have the required stability and compaction during placement, and no rutting or displacement of the roadbed shall occur when the material for the base or surfacing is placed on the subgrade.

Private drives, minor road approaches, and areas of irregular dimension or restricted access shall be shaped and compacted to the required stability, with no specified density.

The Department will set appropriate stakes for use in shaping the subgrade to the required section and to the established grade. The Contractor shall preserve the line and grade stakes as long as they are needed.

2. **Subgrade Preparation Type A.** This work shall meet Section 230.02 B.1.
3. **Subgrade Preparation Type B.** This work shall meet Section 230.02 B.1 and the following:

Special requirements for moisture and density control will be noted on the Plans.

Before placing any base or surfacing material on the roadbed, the subgrade shall be brought to the required grade and cross section using a roadbed planer conforming to Section 153.06. Grade control will be taken from the taut string line erected parallel to the established grade line, except the Engineer may permit a base or surface course to be used as a grade reference for trimming the shoulders. Taut string lines shall be erected and maintained for operating the automatic controls on the trimming equipment. The subgrade elevation shall not vary from any point by more than 0.04 foot from the prescribed elevation.

4. **Subgrade Preparation Type A (Shoulders).** When included as a separate bid item, "Subgrade Preparation Type A (Shoulders)" consists of removing some or all of the existing base and surfacing from the shoulders, reshaping and recompacting the shoulder subgrade; and replacing and recompacting some or all of the base or surface material removed. Specific requirements will be as shown on the Plans.
5. **Subgrade Preparation Type C.** The existing shoulder material and mainline surfacing shall be removed and hauled to the plant site, or disposed of as shown on the Plans. The newly exposed subgrade shall be scarified to the depth specified and recompacted. Soft or wet areas not identified as subcut areas shall be aerated and recompacted, or excavated and backfilled with suitable backfill. Rocks, roots, and any objects which may interfere with compaction and trimming the subgrade shall be removed and disposed of under Section 203.02 D. The subgrade shall be trimmed to the required grade and cross section under Section 230.02 B.3 before any salvaged base course is placed on the subgrade. The equipment shall provide for automatic control of the grade and cross slope of the cutting edges.

The moisture and density controls will be the same as those specified on the plans for embankment and cut areas. The subgrade shall be compacted in 6 inch layers to the depth of subgrade preparation specified. If the subgrade is unstable (as evidenced by sponginess or rutting) when compacted to the required density, the soils shall be dried to obtain adequate stability. This may require drying below optimum moisture. The cost of such drying will be incidental to the price bid for subgrade preparation.

Subgrade Preparation Type C (12") and Subgrade Preparation Type C (18") may both be required on this Project. If the specified density and stability cannot be obtained by manipulating and drying the required depth of subgrade because of excessive moisture or frost action, work shall be suspended without additional payment to the Contractor to allow the subgrade to recover its strength. If the Engineer directs manipulation and drying below a 18-inch depth, payment will be made according to Section 104.03 D.

The Contractor shall maintain the subgrade and repair any damage resulting from construction operations. Base or surface material shall not be placed until the subgrade has been checked and approved by the Engineer.

The Department will set appropriate stakes for use in shaping the subgrade to the required section and to the established grade. The Contractor shall preserve the line and grade stakes as long as they are needed.

6. **Aggregate for Subgrade Repair.** Aggregate to repair specific areas shown on the Plans shall meet the requirements of Class 3 aggregate under Section 816.03.

230.03 METHOD OF MEASUREMENT.

- A. **Reshaping Roadway.** Reshaping roadway will be measured by the Mile or Station of reshaped roadway.
- B. **Shoulder Preparation.** Shoulder preparation will be measured by the Miles or Stations of shoulder prepared as specified. Each shoulder will be measured separately.
- C. **Reshaping Inslopes.** Inslopes that have been reshaped as specified will be measured by the Miles or Stations. Inslopes on each side of the roadway will be measured separately.
- D. **Subgrade Preparation.** The quantity of Type A, Type B, Type C (12"), or Type C (18") Subgrade Preparation will be the number of Miles or Square Yards prepared and accepted, measured along the centerline of the road. Areas outside the roadbed, such as private drives, road approaches, road tapers, and ramps will not be measured for payment but will be considered part of the mainline measurements.
- E. **Subgrade Preparation Type A (Shoulders).** Shoulder subgrade preparation will be measured by the Miles or Stations of subgrade preparation completed and accepted. Each shoulder will be measured separately.
- F. **Water.** The quantity of Water used will be measured under Section 216.05.
- G. **Excavation, Removal, and Backfill.** The quantity of excavation and removal of undesirable material will not be measured. Backfill material will be measured by the Cubic Yard and classified "Common Excavation, Subgrade Repair."
- H. **Topsoil.** Topsoil will not be measured for payment.
- I. **Aggregate of Subgrade Repair (Class 3).** Aggregate will be measured by the Ton or Cubic Yard as specified. Unit price will include providing, hauling, placing, and compacting the material.

230.04 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Item	Pay Unit
Reshaping Roadway	Mile or Station
Subgrade Preparation Type A	Mile or Station
Subgrade Preparation Type B	Mile or Station
Subgrade Preparation Type C (12")	Mile or Station
Subgrade Preparation Type C (18")	Mile or Station
Shoulder Preparation	Mile or Station
Reshaping Inslopes	Mile or Station

Subgrade Preparation Type A (Shoulders)
 Aggregate for Subgrade Repair (Class 3)
 Common Excavation, Subgrade Repair
 Water

Mile or Station
 Ton or Cubic Yard
 Cubic Yard
 "M" Gallon

Full compensation for excavation, removal, and disposal of undesirable subgrade material will be paid according to Section 104.03 D. If the Contractor is directed to use backfill material other than "Common Excavation, Subgrade Repair," the backfill material will be paid for at the Contract Unit Price bid for that material.

Excavation and hauling of material from one point to another on the roadbed to adjust the grade line will be paid according to Section 104.03 D.

The cost of removing, stockpiling, and replacing topsoil along the reshaped inslopes will be included in the prices bid for the reshaping and subgrade preparation items.

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 234 STABILIZED SUBGRADE

234.01 DESCRIPTION.

This work consists of treating the top layer of subgrade with lime or lime-fly ash.

234.02 MATERIALS.

Materials shall meet the following:

Item	Section
Lime	804.02
Fly Ash	820
Water	812

234.03 EQUIPMENT.

Equipment shall meet the following:

Item	Section
General	151.01
Material Hauling Equipment	151.03 B
Water-Hauling Equipment	151.03 A
Tow-Type Pneumatic-Tired Rollers	151.02 A
Self-Propelled Pneumatic-Tired Rollers	151.02 B

234.04 CONSTRUCTION REQUIREMENTS.

The roadbed shall be shaped to the cross section shown on the Plans. The roadbed material shall be scarified or disked to a depth of 6 inches, 12 inches, 18 inches, 24 inches, or more as required. Any work that the Engineer requires to be done below a 24-inch depth will be paid according to Section 104.03 D. The bottom 6 inches of the scarified or disked depth shall remain on the roadway, mixed with lime, and worked in place. The subgrade shall be replaced in 6 inch lifts, aerated, mixed with lime or lime-fly ash, and recompact as directed by the Engineer. Section 104.03 B will not apply to lime or lime-fly ash. Any wet or unstable materials below the scarified section shall be corrected as directed by the Engineer.

- A. **Spreading.** The lime or lime-fly ash shall be spread by dry application or slurry at the rates shown on the Plans. The lime and fly ash may be applied together or separately, provided the lime is applied before the fly ash. Both lime and fly ash shall be distributed uniformly without loss of material by wind or other causes. Lime or fly ash shall not be applied by dry application when the wind is 15 mph or greater.

Slurry shall be used in areas adjacent to residential or other developed areas so the lime or lime-fly ash does not damage, discomfort, or be an inconvenience to public or private property. The lime or lime-fly ash shall be premixed with water in approved agitating equipment in proportions so that the "Dry-Solids Content" is at least 30% by weight. Lime or lime-fly ash and water may be similarly proportioned in distributing equipment, provided the equipment contains approved metering devices which accurately meters the quantity of water, lime, or lime-fly ash into the distributing tank to provide positive controls for proper proportioning of the mixture.

All distributing equipment shall provide continuous and adequate agitation until the slurry is applied to the roadbed. The slurry shall be applied through pressurized distributing spray bars. Adequate means of accurately determining distribution of lime or lime-fly ash on each area shall be provided. Each distributing unit shall be provided with a metering device which accurately determine the "Dry-Solids Content" applied to any area, based on the percentage of lime or lime-fly ash in the slurry. The application of lime or lime-fly ash may also be controlled by weight or by measuring and converting to weight each load or partial load applied, and basing the dry-solids content on the percentage of lime or lime-fly ash in the slurry.

The total application of lime or lime-fly ash ordered shall be attained by successive passes of the distributing equipment over a measured area.

The slurry may be applied directly to the scarified or disked subgrade, provided no loss of lime or lime-fly ash slurry is evident and uniform distribution into the soil can be made.

- B. **Mixing.** The lime or lime-fly ash shall be thoroughly mixed with the material to be processed with enough water added to the mixture to maintain not less than optimum moisture content. Mixing shall be accomplished by the use of a rotary mixer. It shall be mixed so that 100% of the material passes a one inch sieve. If the material does not readily mix with the lime or lime-fly ash, it shall be thoroughly mixed, brought to the proper moisture content, and left to cure 24 to 48 hours.

- C. **Compacting and Finishing.** Compaction shall begin immediately after the material has been spread to the specified section. The stabilized subgrade shall be compacted to the density specified in the Plans.

If 6 inches are scarified or disked, the 6 inches shall be compacted until a uniform specified density is obtained. If more than 6 inches are scarified or disked, the top 12 inches shall be compacted until a uniform specified density is obtained.

Subgrade material that can not be compacted to the required stability shall be removed and replaced with approved material. Rocks, roots, and any other material that may interfere with compaction and shaping to grade and cross section shall be removed and disposed of under Section 203.02 D. If the required stability cannot be achieved through manipulation and drying after the subgrade is scarified to the required depth, the Engineer will determine what further subgrade work is necessary.

When imprints from equipment are left in the finished surface, the surface shall be lightly scarified and recompacted. The moisture content of the surface material must be maintained at its specified optimum during all finishing operations.

The Engineer may suspend the work if instability of the subgrade is caused by frost or excess moisture. A suspension for these reasons shall not constitute a basis for a claim for payment of any Contractor losses.

Mixing shall not be performed after October 1 and shall not be resumed in the spring until the ground is frost free.

- D. **Curing.** The completed surface of the treated subgrade shall be kept in a continuously moist condition until an application of bitumen is applied to the surface as a protective cover to prevent moisture loss.

Liquid Asphalt for curing shall be applied according to Section 401.

234.05 METHOD OF MEASUREMENT.

- A. **Lime or Lime-Fly Ash Treated Subgrade.** Lime Treated Subgrade or Lime-Fly Ash Treated Subgrade will be measured by the Square Yard or Mile. At any given area, only one of the Treated Subgrade bid items will be paid, unless a second depth is specified by the Engineer. When a second depth of treatment is ordered, payment will be made for both the first and the second depth of "Lime or Lime-Fly Ash Treated Subgrade" at the price bid.

Cost associated with scarification and recompaction of the subgrade will not be paid separately but shall be included in the price bid for "Lime or Lime-Fly Ash Treated Subgrade."

- B. **Lime.** Lime will be measured by the Ton.
- C. **Water.** Water will be measured under Section 216.
- D. **Liquid Asphalt.** Liquid Asphalt will be measured under Section 109.
- E. **Fly Ash.** Fly Ash will be measured by the Ton.

234.06 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Item	Pay Unit
Lime Treated Subgrade ____ inches	Square Yard or Mile
Lime-Fly Ash Treated Subgrade ____ inches	Square Yard or Mile
Hydrated Lime	Ton
Fly Ash	Ton
Water	M. Gallons
Liquid Asphalt for Curing	Gallons

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

SECTION 300
BASES

SECTION 302
AGGREGATE BASE OR SURFACE COURSE

- 302.01 DESCRIPTION
- 302.02 MATERIALS
 - A. Aggregate
 - B. Acceptance
- 302.03 EQUIPMENT
- 302.04 CONSTRUCTION REQUIREMENTS
 - A. Pit Operations
 - B. Subgrade Preparation
 - C. Depositing and Laydown
 - D. Compaction
 - E. Application of Water
 - F. Surface Tolerance
 - G. Limitations
 - H. Maintenance of Completed Course
- 302.05 METHOD OF MEASUREMENT
- 302.06 BASIS OF PAYMENT

SECTION 304
PERMEABLE STABILIZED BASE COURSE

- 304.01 DESCRIPTION
- 304.02 MATERIALS
 - A. Aggregate
 - B. Asphalt
 - C. Portland Cement
- 304.03 EQUIPMENT
- 304.04 CONSTRUCTION REQUIREMENTS
 - A. General
 - 1. Subbase
 - 2. Finished Surface
 - 3. Traffic
 - 4. Pavement Edge
 - 5. Placement
 - 6. Tolerance in Base Thickness
 - B. Asphalt Stabilized Base
 - 1. Material Production and Placement
 - 2. Compaction
 - 3. Weather Limitations
 - C. Portland Cement Treated Base
 - 1. Material Production
 - 2. Placement
- 304.05 METHOD OF MEASUREMENT
- 304.06 BASIS OF PAYMENT

SECTION 306
BLENDED BASE COURSE

- 306.01 DESCRIPTION
- 306.02 MATERIALS
 - A. Blended Material
 - B. Aggregate
 - C. Acceptance
 - 1. Aggregate
 - 2. Blended Material
- 306.03 EQUIPMENT
- 306.04 CONSTRUCTION REQUIREMENTS
 - A. Pit Operations
 - B. Adding Corrective Material
 - C. Aggregate Placement and Blending
 - D. Blending Depth
 - E. Placement and Compaction of Blended Material
 - F. Soft Areas
 - G. Application of Water
 - H. Surface Tolerance
 - I. Limitations
 - J. Maintenance of Completed Courses
- 306.05 METHOD OF MEASUREMENT
 - A. Blended Base Course
 - B. Remove and Relay Blended Base Course
 - C. Aggregate
 - D. Water
- 306.06 BASIS OF PAYMENT

SECTION 302 AGGREGATE BASE OR SURFACE COURSE

302.01 DESCRIPTION.

This work consists of furnishing and placing one or more courses of aggregate and additives on a prepared foundation.

302.02 MATERIALS.

- A. **Aggregate.** Aggregates shall meet Section 816 for the class of aggregate specified.
- B. **Acceptance.** A lot is defined as one day's production if production is greater than 1,000 tons per day. If production is less than 1,000 tons per day, then a lot is as many days' production as necessary to reach 1,000 tons. If plan quantity is less than 1,000 tons, a lot shall be equal to plan quantity. A day's production will not be split into more than one lot.

Three random samples will be taken for each lot of material placed. If the base material is placed in a windrow on the roadway, the sample will be taken from the equalized aggregate windrow according to the procedures outlined in NDDOT's *Field Sampling and Testing Manual*. If construction operations do not require that the base material be equalized in a windrow, the sample will be taken according to the procedures outlined in AASHTO T-2 with the belt sample given first priority. These samples will be tested and the material accepted if the average of the 3 samples meets the gradation specified. If the material from all 3 samples meets the gradation specified only one of the 3 samples will be tested from each subsequent lot. If the sample tested does not meet the gradation requirements, the remaining 2 samples will be tested. The average gradation of these 3 samples will then be used to determine acceptance of the material. The testing of 3 samples per lot will continue until all 3 samples meet the gradation specified then only one of the 3 samples will be tested from each subsequent lot. When the aggregate does not meet the gradation specified, a reduction in the Contract Unit Price will be made. If the aggregate fails to meet the specified gradation on one or more sieves, the reduction will be the sum of the deductions as calculated below.

Unit Price Reduction: $\text{Percent of Deduction} = 5 \times \text{percent of deviation from range limits.}$

If material is produced that deviates from the specified gradation for 2 consecutive lots incorporation of additional material into the work will not be allowed until the Contractor takes the necessary corrective action to meet the specifications.

The physical properties of the aggregate will be determined from three random samples taken from the stockpile from each lot of 10,000 tons or fraction thereof.

If a fraction of a lot is less than 2,500 ton, it will be included with the previous lot of 10,000 tons. If the material from all three samples is within the specified limits, only one of the three samples will be tested from each subsequent lot. If at anytime the sample tested fails to meet the specified limits, the remaining 2 samples will be tested and the physical properties of each lot will be determined by the average of these 3 test results. The testing of three samples per lot will continue until all three samples are within the specified limits then only one of the three samples will be tested from each subsequent lot. If the average exceeds the specified limits for shale, the unit price for aggregate will be adjusted according to Section 302.06. If the average exceeds the specified limits for plasticity index or fractured faces, the Contractor shall correct the stockpile so the material meets specifications.

The L.A. Abrasion loss percentage will be determined on the basis of one composite aggregate sample taken and tested during the beginning of the aggregate stockpiling. If the aggregate source has been tested previously by the Department and the material is within the allowable limits, the tests for the L.A. Abrasion loss percentage will not be required.

302.03 EQUIPMENT.

Equipment shall meet the following:

Item	Section
General	151.01
Water-Hauling Equipment	151.03 A
Material-Hauling Equipment	151.03 B
Tow-Type Pneumatic-Tired Rollers	151.02 A
Self-Propelled Pneumatic-Tired Rollers	151.02 B

302.04 CONSTRUCTION REQUIREMENTS.

- A. **Pit Operations.** Stripping of the pit and pit operations shall be according to Section 106.02 and other Contract requirements to produce an aggregate meeting the specification for the class specified.
- B. **Subgrade Preparation.** Subgrade preparation shall be completed according to Section 230.02 B.2.
- C. **Depositing and Laydown.** The aggregate shall be deposited, spread, and shaped so the moist and compacted course conforms to the required grade and cross section within the tolerance specified in this Section.
- D. **Compaction.** Compaction shall be carried out simultaneously with laydown operations, and the compacted depth of a single course shall not exceed 6 inches. All equipment shall be operated to produce uniform density throughout the entire section. Pneumatic-tired rollers of the type specified in Section 151 shall be used. The desired degree of compaction will be considered obtained when the surface is tightly bound and shows no rutting or displacement under roller operation.
- E. **Application of Water.** Water shall be applied according to Section 216 as needed to secure required results.

- F. **Surface Tolerance.** The surface of the completed base shall be tightly bound, smooth, and uniform; and conform to the cross section and grade specified.

Surface tolerance Type A shall be used unless specified.

1. **Surface tolerance Type A.** The finished surface shall not vary from the prescribed cross section elevation by more than 0.08 feet. The longitudinal profile shall not vary by more than 0.08 feet from the grade line established by the Engineer.
2. **Surface Tolerance Type B.** Trimming equipment with automatic grade controls shall be used when surface tolerance Type B is specified. Motor graders may be used as trimming equipment. The automatic grade controls shall adjust for the cross slope and longitudinal profile. The automatic controls shall produce a finished surface that does not vary from the prescribed cross section elevation by more than 0.04 feet from the grade line established by the Engineer.
3. **Surface Tolerance Type C.** Trimming equipment with automatic grade controls shall be used when surface tolerance Type C is specified. The automatic grade controls shall adjust for the cross slope and longitudinal profile. Motor graders shall not be used as trimming equipment. Roadbed planers shall be used as trimming equipment as specified in section 153.06. Grade control shall be taken from a taut string line erected parallel to the grade line established by the Engineer, except the Engineer may permit a base or surface course to be used as a grade reference for trimming the shoulders. The taut string lines shall be erected and maintained so the automatic controls produce a finished surface that does not vary from the prescribed cross section elevation by more than 0.04 feet from the grade line established by the Engineer.

- G. **Limitations.** The quantity of aggregate permitted in windrows on roadways open to traffic, shall not exceed 3 miles. The aggregate shall be laid within 72 hours after being placed in the windrow.

Aggregate shall not be placed on a frozen subgrade.

- H. **Maintenance of Completed Courses.** When the Contract includes successive base courses or base and surface courses, each course shall be maintained in a smooth and compacted condition until the succeeding course is placed.

302.05 METHOD OF MEASUREMENT.

- A. **Subgrade Preparation.** Subgrade preparation will be incidental to aggregate base work. When specified as a pay item, measurement will be made according to Section 230.
- B. **Aggregate Base or Surface Course.** Measurement will be by the Ton or Cubic Yard, as specified.
- C. **Water.** Measurement will be made according to Section 216.

302.06 BASIS OF PAYMENT.

Payment will be made at the Contract Unit Price for the following:

Pay Item

Subgrade Preparation
 Aggregate Base or Surface Course
 Water

Pay Unit

Mile, Station, Square Yard
 Ton or Cubic Yard
 M. Gallons

This payment will be full compensation for all labor, equipment, and materials necessary to complete the work.

When the average of the test results specified in Section 302.02 shows a larger percentage of shale than the maximum allowable specified, a one percent reduction in the unit price will be made for each 0.2% above the allowable percentage. If the percentage of shale exceeds the allowable limit by 3% or more, the material will be rejected unless the material is accepted under Section 105.07.

When a mixture is subject to pay reduction as described in both Sections 302.02 and 302.06, the Bid Price will be reduced by the sum of the price adjustments.

SECTION 304

PERMEABLE STABILIZED BASE COURSE

304.01 DESCRIPTION.

This work consists of constructing a permeable stabilized base course mixed in a central plant and placed on a prepared subbase. The Contractor shall have the option of using Portland Cement or Asphalt Cement as a stabilizing agent to stabilize the base course.

304.02 MATERIALS.

- A. **Aggregate.** The aggregate shall be a Class 7 aggregate as specified in Section 816.03.

Each lot of aggregate will be sampled by the Contractor, under the observation of and at random locations determined by the Engineer. A lot is defined as one day's production if production is greater than 4,500 square yards per day. If production is less than 4,500 square yards per day, then a lot is as many days' production as necessary to place 4,500 square yards. If plan quantity is less than 4,500 square yards, a lot shall be equal to plan quantity. A day's production will not be split into more than one lot.

Three random samples for each lot will be obtained by the Contractor, under the observation of and at a location determined by the Engineer. The sampling procedures shall meet the requirements of AASHTO T-2. These samples will be tested and the material accepted if the average of the 3 samples meets the gradation specified. If the material from all 3 samples meets the gradation specified only one of

the 3 samples will be tested from each subsequent lot. If the sample tested does not meet the gradation requirements, the remaining 2 samples will be tested. The average gradation of these 3 samples will then be used to determine acceptance of the material. The testing of 3 samples per lot will continue until all 3 samples meet the gradation specified then only one of the 3 samples will be tested from each subsequent lot. When the aggregate does not meet the gradation specified, a reduction in the Contract Unit Price will be made. If the aggregate fails to meet the specified gradation on one or more sieves, the reduction will be the sum of the deductions as calculated below.

Unit Price Reduction:

Percent of Deduction = $5 \times$ percent of deviation from range limits.

If material is produced that deviates from the specified gradation for 2 consecutive lots incorporation of additional material into the work will not be allowed until the Contractor takes the necessary corrective action to meet the specifications.

The physical properties of the aggregate will be determined from three random samples taken from the stockpile for each lot of 10,000 tons or fraction thereof. If a fraction of a lot is less than 2,500 ton, it will be included with the previous lot of 10,000 tons. If the material from all three samples is within the specified limits, only one of the three samples will be tested from each subsequent lot. If at anytime the sample tested fails to meet the specified limits, the remaining 2 samples will be tested and the physical properties of each lot will be determined by the average of these 3 test results. The testing of three samples per lot will continue until all three samples are within the specified limits then only one of the three samples will be tested from each subsequent lot. If the average exceeds the specified limits for shale, the unit price for aggregate will be adjusted according to Section 302.06. If the average does not meet the specified limits for fractured faces, the Contractor shall correct the stockpile so the material meets specifications.

The L.A. Abrasion loss percentage will be determined on the basis of one composite aggregate sample taken and tested during the beginning of the aggregate stockpiling. If the aggregate source has been tested previously by the Department and the material is within the allowable limits, the tests for the L.A. Abrasion loss percentage will not be required.

- B. Asphalt.** The asphalt cement shall be an AC 20 asphalt meeting the requirements of Section 818.02 A.2.

The bitumen shall be added to the aggregate uniformly at a rate of 2 1/2% by weight of the mix.

If the daily cutoff for the asphalt cement, as determined on the Mix Bitumen Cutoff Report, deviates from the target percentage specified by more than 0.24 percentage points, the pay factor will be determined as specified in Section 408.05 B.1.

- C. Portland Cement.** The Portland Cement shall meet the requirements of Section 804.01.

The Portland Cement content shall be 200 pounds per cubic yard. Batching of the cement shall be according to Section 802.04 B. Aggregates and bulk cement shall be proportioned by automatic batching equipment according to Section 153.01 B.

304.03 EQUIPMENT.

Equipment shall meet the following:

Item	Section
General	151.01
Rollers	151.02 C
Material Hauling Equipment	151.03 B
Bituminous Pavers	151.04
Scales	151.07
Hot Bituminous Equipment	152
Roadbed Planer	153.06
P.C.C. Equipment	153

304.04 CONSTRUCTION REQUIREMENTS.**A. General.**

1. **Subbase.** Before placing the permeable base, the subbase shall be trimmed to the required grade and cross section by a roadbed planer. The finished surface of the subbase shall not vary by more than 0.04 foot from the prescribed elevation.

A prime coat shall be applied to establish an impermeable layer below the permeable base. The prime coat shall be allowed to cure a minimum of 24 hours before the permeable base is placed.

2. **Finished Surface.** The surface of the permeable base shall be smooth and uniform, and shall not vary by more than 0.04 foot from the prescribed elevation. Trimming of the permeable base will not be permitted. Care shall be exercised to prevent contamination of the permeable base. Procedures that might produce fine material that would tend to clog or reduce drainage will not be permitted. Permeable base which, in the opinion of the Engineer, has been contaminated shall be removed and replaced at the Contractor's expense.
3. **Traffic.** Hauling on the permeable base will not be allowed. Traffic over the permeable base will be limited to the minimum necessary for succeeding or adjacent work. Damage to the permeable base shall be repaired promptly at the Contractors expense.
4. **Pavement Edge.** The outlet edge of the permeable base shall be kept open (daylighted) until the edge drain is placed so that water is free to exit.
5. **Placement.** The permeable base shall be placed in one lift at the specified thickness. The base will be placed with a mechanical spreader, except when placing the base in small areas that are not accessible to large equipment. In these areas the base may be hand placed and compacted with mechanical hand tampers. The mechanical spreader shall utilize automatic controls with a stringline to control the longitudinal profile.

If approved by the Engineer, the permeable base may be placed without the stabilizing agent in small areas that are formed by hand.

6. **Tolerance in Base Thickness.** Immediately after compaction of the permeable base, the thickness will be determined. The depth checks will be at random locations determined by the Engineer. Depth checks will be conducted at a frequency of two sets per 4,500 square yards. A minimum of 2 sets of depth checks will be conducted for areas less than 4,500 square yards.

A set of depth checks shall consist of placing three metal plates across the roadway at each random location. The plates shall be placed on top of the primed surface. The thickness will be determined by inserting a metal measuring device through the permeable base until the device contacts a metal plate. The depth of insertion shall be recorded.

If the permeable base placed has an average thickness in excess of that specified, additional payment will not be made. If the average pavement thickness is deficient by more than one inch, the base will be removed and replaced at the Contractors expense. If deficient by less than one inch in thickness, price adjustments will be made to the Contract Unit Price for each lot of 4,500 square yards as provided in the following table:

Deficiency in Thickness (Inches)	Pay Factor
0.0 to 0.25	1.00
0.26 to 0.50	.90
0.51 to 0.75	.70
0.76 to 1.00	.50

B. Asphalt Stabilized Base.

1. **Material Production and Placement.** The permeable base shall be produced at a central hot mix plant according to Section 408.04 E and 408.04 F, paragraph one. The material produced shall be placed with a bituminous paver.
2. **Compaction.** Compaction of the permeable base shall be according to Section 302.04 E. except the roller shall be a 10 ton, double drum, steel wheeled roller. No vibration will be allowed. The Contractor is advised that it may be necessary to permit the permeable base to cool sufficiently before compaction rolling to prevent rutting and shoving. Cooling to 150°F. may be appropriate, but in no case shall the mix be less than 110°F. at time of compaction. Water may not be used to hasten the cooling process.
3. **Weather Limitations.** Weather limitations shall be as specified in Section 408.04 M.1.

C. Portland Cement Treated Base.

1. **Material Production.** The Permeable base shall be mixed at a stationary mixing plant capable of producing a uniform mixture and shall be equipped with feeding and/or weighing devices that are capable of proportioning the mixture as specified.

The water/cement ratio shall provide for 100% cement (paste) coverage of aggregate. The intent is to add the minimum amount of water to obtain a uniform workable mix.

2. **Placement.** The cement stabilized base shall be placed with a slip form paver or a mechanical spreader capable of placing the material in one layer. The paver or spreader shall be equipped with automatic grade control that maintains the proper elevation at both sides by: (1) controlling the elevation of one side and the slope, or (2) controlling the elevation of each side independently. The grade reference shall be an erected string line or other approved method.

The cement stabilized base shall be consolidated with surface pan type vibrators. The frequency of the surface pan type vibrators shall not be less than 4000 impulses per minute, unless modified by the Engineer.

If the surface below the cement stabilized base is not primed, it shall be made uniformly moist prior to placing the base.

The cement stabilized base shall be allowed to cure a minimum of 48 hours before placement of the surface course. Exceptions may be made, with the Engineer's approval, in areas where immediate access is necessary to accommodate traffic.

Weather limitations shall be as specified in Section 602.03 G.3.

When placing the stabilized base at bridge ends, ramp tapers or other areas where placement is not practical with a mechanical spreader, the base material may be placed with a loader and compacted with a 10 ton steel wheeled roller in the static mode.

304.05 METHOD OF MEASUREMENT.

Permeable Stabilized Base Course. Permeable Stabilized Base shall be measured by the square yard placed, and accepted by the Engineer.

304.06 BASIS OF PAYMENT.

The accepted quantity of permeable stabilized base will be paid for at the contract price bid per square yard. The price shall be full compensation for all materials (including the asphalt or portland cement binder), equipment, labor, and incidentals required to construct this item of work as specified.

SECTION 306 BLENDED BASE COURSE

306.01 DESCRIPTION.

This work consists of blending and placing the existing aggregate base, existing bituminous surfacing and possibly one or more courses of aggregate into a uniform base material.

306.02 MATERIALS.

- A. **Blended Material.** The blended material shall have 97 to 100% passing a 2-inch sieve and 90 to 100 percent passing a 1 1/2 inch sieve.
- B. **Aggregate.** The aggregate shall meet Section 816 for a Cl. 3M aggregate.
- C. **Acceptance.**
 - 1. **Aggregate.** The Cl. 3M aggregate or the aggregate specified to blend with the existing material, will be accepted in lots. A lot is defined as one day's production if production is greater than 1,000 tons per day. If production is less than 1,000 tons per day, then a lot is as many days' production as necessary to reach 1,000 tons. If plan quantity is less than 1,000 tons, a lot shall be equal to plan quantity. A day's production will not be split into more than one lot.

Three random samples will be taken for each lot of material placed. The sample shall be obtained from the equalized aggregate windrow prior to the blending operation according to the procedures outlined in NDDOT's *Field Sampling and Testing Manual*. The samples will be tested and the material accepted if the average of the 3 samples meets the gradation specified. If the material from all 3 samples meets the gradation specified, only one of the 3 samples will be tested from each subsequent lot. If the sample tested does not meet the gradation requirements, the remaining 2 samples will be tested. The average gradation of the 3 samples will be used to determine acceptance of the material. The testing of 3 samples per lot will continue until all 3 samples meet the gradation specified then only one of the 3 samples will be tested from each subsequent lot. When the aggregate does not meet the gradation specified, a reduction in the Contract Unit Price will be made. If the aggregate fails to meet the specified gradation on one or more sieves, the reduction will be the sum of the deductions as calculated below.

Unit Price Reduction:

Percent of Deduction = $5 \times$ percent of deviation from range limits

If material is produced that deviates from the specified gradation for 2 consecutive lots incorporation of additional material into the work will not be al-

lowed until the Contractor takes the necessary corrective action to meet the specifications.

The physical properties of the aggregate will be determined from three random samples from the stockpile from each lot of 10,000 tons or fraction thereof. If a fraction of a lot is less than 2,500 tons, it will be included with the previous lot of 10,000 tons. If the material from all three samples is within the specified limits, only one of the three samples will be tested from each subsequent lot. If at anytime the sample tested fails to meet the specified limits, the remaining 2 samples will be tested and the physical properties of each lot will be determined by the average of these 3 test results. The testing of three samples per lot will continue until all three samples are within the specified limits then only one of the three samples will be tested from each subsequent lot. If the average exceeds the specified limits for shale, the unit price for aggregate will be adjusted according to Section 302.06. If the average exceeds the specified limits for plasticity index or fractured faces, the Contractor shall correct the stockpile so the material meets specifications.

The L.A. Abrasion loss percentage will be determined on the basis of one composite aggregate sample taken and tested during the beginning of the aggregate stockpiling. If the aggregate source has been tested previously by the Department and the material is within the allowable limits, the tests for the L.A. Abrasion loss percentage will not be required.

2. **Blended Material.** When the blending process begins, the blended material shall be sampled and tested a minimum of two times per day to assure 97 to 100 percent of the material passes a 2-inch sieve and 90 to 100 percent passes a 1 1/2-inch sieve. When the Engineer is satisfied the Contractor is producing blended material within the specified limits, random tests will be taken as determined by the Engineer to assure compliance.

306.03 EQUIPMENT.

Equipment shall meet the following:

Item	Section
General	151.01
Water-Hauling Equipment	151.03 A
Material-Hauling Equipment	151.03 B
Tow-Type Pneumatic-Tired Rollers	151.02 A
Self-Propelled Pneumatic-Tired Rollers	151.02 B
Vibratory Sheep foot/pad foot/ Extended pad foot Rollers	151.02 F
Mining/Blending Machine	151.08

306.04 CONSTRUCTION REQUIREMENTS.

- A. **Pit Operations.** Stripping of the pit and pit operations shall be according to Section 106.02 and other Contract requirements to produce an aggregate meeting the specification for the class specified.
- B. **Adding Corrective Material.** When a combination of materials is required to produce the class of aggregate specified, the aggregate may be blended at the pit or on the road to produce the specified material.

- C. **Aggregate Placement and Blending.** When “Blended Base Course” is specified, the aggregate supplied to be blended with the existing material will be placed and compacted on the roadway to plan cross slope and to a longitudinal profile approved by the engineer prior to blending. It is intended for the contractor to use mining/blending equipment that rides on the existing surface. If the Contractor elects to use equipment that rides on the subgrade, the Contractor shall assure the equipment has sufficient weight distribution to prevent rutting or displacement of the subgrade below the blended material. Any damage caused by the contractor’s equipment riding on the subgrade shall be repaired at the Contractor’s expense.

When “Remove and Relay Blended Base Course” is specified, the Contractor may elect to blend the material on or off the roadway. The use of a Motor Grader to blend the material will not be permitted. The Contractor must prove to the Engineer that the process used to blend the material will provide a uniformly blended base course.

- D. **Blending Depth.** The existing asphalt pavement depth varies. The pavement depths shown in the plans are from cores taken at specified locations. Primed aggregate and bituminous treated base (if present) are not included in the pavement depth. The actual pavement depths at other locations may vary. The Contractor is responsible for interpreting the pavement depths and including all costs in the bid price to process the required depth of existing pavement and existing aggregate.

When “Blended Base Course” is specified, the Contractor shall blend to: the depth shown in the plans or, if the depth shown in the plans is not great enough to process all of the existing surfacing, bituminous treated base (where present), and the existing base, the blending depth shall be increased to the lesser of the following depths:

1. A depth great enough to process all of the supplemental aggregate, existing surfacing and bituminous treated base (where present).
2. A minimum of 18”, measured from top of supplemental compacted aggregate. The distance between the existing asphalt material not mined and the new pavement (asphalt or concrete) shall be a minimum of 18”.

During the blending operation the Contractor shall physically dig down, approximately every five hundred feet (each pass), to check the blending depth and visually verify the full depth of bituminous pavement has been blended without contamination from the subgrade.

When “Remove and Relay Blended Base Course” is specified, and if the Contractor elects to blend the material off the roadway, the entire depth of asphalt pavement shall be removed and blended with the aggregate specified.

- E. **Placement and Compaction of Blended Material.** After blending, the Contractor shall place the blended material as shown in the Plans. The blended material shall be uniform in gradation and compacted to produce a uniform density throughout the entire section. If the material is deficient in moisture content, it shall be moistened to the degree necessary to attain compaction.

Compaction shall be carried out simultaneously with lay down operations. The vibratory sheep foot/pad foot/extended pad foot roller shall be used to obtain com-

paction until the feet/pads ride up close to the surface of the blended base. After this, the road top shall be compacted with a pneumatic roller until the surface is tightly bound and shows no sign of rutting or displacement under the compaction operations or traffic. Vibratory sheep foot/pad foot/extended pad foot and pneumatic tired rollers of the type specified in Section 151 shall be used.

- F. **Soft Areas.** Unstable areas, as determined by the Engineer, that appear after the blended base has been compacted shall be repaired by the Contractor. If the unstable areas are due to poor compaction of the blended base, the Contractor will rework the blended base to obtain adequate compaction. The cost of reworking the blended base will be included in the item "Blended Base Course."

If the unstable areas are due to the subgrade, the Engineer may direct manipulation and drying of the subgrade. Payment for this work will be in accordance with Section 104.03 of the Standard Specifications.

- G. **Application of Water.** Water shall be applied according to Section 216 as needed to secure required results.
- H. **Surface Tolerance.** The surface of the completed base shall be tightly bound, smooth, uniform, and conform to the cross section and grade specified. The surface shall be finished using a Surface tolerance Type B as specified in Section 302.04 G.
- I. **Limitations.** The quantity of aggregate or blended material permitted in windrows on roadways open to traffic, shall not exceed 3 miles. The aggregate or blended material shall be laid within 72 hours after being placed in the windrow.

Aggregate or blended material shall not be placed on a frozen subgrade.

- J. **Maintenance of Completed Courses.** When the Contract includes successive base courses or base and surface courses, each course shall be maintained in a smooth and compacted condition until the succeeding course is placed.

306.05 METHOD OF MEASUREMENT.

- A. **Blended Base Course.** Measurement and payment of the bid item "Blended Base Course" will be by the Square Yard based on the width of the existing asphalt pavement from the outside edge of the slough to the outside edge of the slough.
- B. **Remove and Relay Blended Base Course.** Measurement and payment of the bid item "Remove and Relay Blended Base Course" will be by the Ton or Square Yard. When paid by the Square Yard the quantity will be determined by the width of the existing asphalt pavement from the outside edge of the slough to the outside edge of the slough.
- C. **Aggregate.** Measurement will be by the Ton or Cubic Yard, as specified.
- D. **Water.** Measurement will be made according to Section 216.

306.06 BASIS OF PAYMENT.

Payment will be made at the contract Unit Price for the following:

Pay Item	Pay Unit
Aggregate	Ton or Cubic Yard
Water	M. Gallons
Blended Base Course	Square Yard
Remove and Relay Blended Base Course	Square Yard or Ton

This payment will be full compensation all labor, equipment, and materials necessary to complete the work as required.

When the average of the test results specified in Section 306.02, shows a larger percentage of shale than the maximum allowable specified, a 1% reduction in the unit price will be made for each 0.2% above the allowable percentage. If the percentage of shale exceeds the allowable limit by 3% or more, the material will be rejected unless the material is accepted under Section 105.07.

When a mixture is subject to pay reduction as described in Sections 306.02 and 306.06, the Bid Price will be reduced by the sum of the price adjustments.

SECTION 400
BITUMINOUS PAVEMENTS

SECTION 401
PRIME, TACK, OR FOG COAT

- 401.01 DESCRIPTION
- 401.02 MATERIALS
 - A. Bitumen
 - B. Blotter Material
- 401.03 EQUIPMENT
- 401.04 CONSTRUCTION REQUIREMENTS
 - A. Preparation of Surface
 - B. Application of Bitumen
 - C. Application of Blotter Material
 - D. Maintenance and Opening to Traffic
 - E. Limitations
- 401.05 METHOD OF MEASUREMENT
- 401.06 BASIS OF PAYMENT

SECTION 402
COLD BITUMINOUS PAVEMENT

- 402.01 DESCRIPTION
- 402.02 MATERIALS
 - A. Bitumen
 - B. Aggregate.
- 402.03 EQUIPMENT
- 402.04 CONSTRUCTION REQUIREMENTS
 - A. Pit Operations
 - B. Conditioning Existing Surface
 - C. Heating of Bitumen
 - D. Hauling and Mixing Aggregates
 - E. Mixing of Aggregates and Bitumen
 - 1. General
 - 2. Blade Mix
 - 3. Traveling Mixer
 - 4. Stationary Plant
 - F. Spreading and Finishing
 - G. Compaction
 - H. Completed Surface
 - I. Maintenance of Completed Surface
 - J. Limitations
- 402.05 METHOD OF MEASUREMENT
- 402.06 BASIS OF PAYMENT

SECTION 403
STOCKPILED HOT BITUMINOUS MIX

- 403.01 DESCRIPTION

- 403.02 MATERIALS
 - A. Bitumen
 - B. Aggregate
- 403.03 EQUIPMENT
- 403.04 CONSTRUCTION REQUIREMENTS
 - A. Pit Operations and Stockpiling of Material
 - B. Preparation of Bituminous Material
 - C. Preparation of Aggregate
 - D. Mixing
- 403.05 METHOD OF MEASUREMENT
- 403.06 BASIS OF PAYMENT

SECTION 405 REMOVE AND SALVAGE BITUMINOUS PAVEMENT

- 405.01 DESCRIPTION
- 405.02 CONSTRUCTION REQUIREMENTS
 - A. Prepare Stockpile Site
 - B. Remove and Salvage Bituminous Surfacing
 - C. Stockpiling
- 405.03 METHOD OF MEASUREMENT
- 405.04 BASIS OF PAYMENT

SECTION 407 HOT RECYCLED BITUMINOUS PAVEMENT

- 407.01 DESCRIPTION
- 407.02 MATERIALS
 - A. Bitumen
 - B. Salvaged Bituminous Material
 - C. Virgin Aggregate
 - D. Recycling Agent
- 407.03 EQUIPMENT
 - A. General
 - B. Recycling Plant
- 407.04 CONSTRUCTION REQUIREMENTS
 - A. Processing Salvaged Material
 - B. Pit Operations and Stockpiling of Aggregate
 - C. Prepare Stockpile Sites
 - D. Mix Design
 - E. Heating of Bitumen
 - F. Preparation of Virgin Aggregate
 - G. Mixing

- H. Mix Temperature
 - I. Conditioning Existing Surface
 - J. Spreading and Finishing
 - K. Compaction
 - 1. General
 - 2. Ordinary Compaction
 - 3. Specified Density
 - L. Joints
 - M. Maintaining Completed Course
 - N. Tolerances
 - O. Limitations
 - 1. Weather
 - 2. Operational
 - P. Bituminous Pavement Sloughs
 - Q. Restore Stockpile Site
- 407.05 ACCEPTANCE
- A. Bitumen Content
 - 1. Average
 - 2. Uniformity
 - B. Compaction
 - C. Aggregate
- 407.06 METHOD OF MEASUREMENT
- 407.07 BASIS OF PAYMENT

SECTION 408

HOT BITUMINOUS PAVEMENT

- 408.01 DESCRIPTION
- 408.02 MATERIALS
- A. Bitumen
 - B. Aggregate
- 408.03 EQUIPMENT
- 408.04 CONSTRUCTION REQUIREMENTS
- A. Pit Operations and Stockpiling of Aggregate
 - B. Mix Design
 - C. Heating of Bitumen
 - D. Preparation of Aggregate
 - E. Mixing
 - F. Mix Temperature
 - G. Conditioning Existing Surface
 - H. Spreading and Finishing
 - I. Compaction
 - 1. General
 - 2. Ordinary Compaction
 - 3. Specified Density
 - J. Joints
 - K. Maintaining Completed Course
 - L. Tolerances

- M. Limitations
 - 1. Weather
 - 2. Operational
 - N. Bituminous Pavement Sloughs
- 408.05 ACCEPTANCE
- A. Aggregate
 - 1. Gradation
 - 2. Additional Aggregate Tests
 - B. Bitumen Content
 - 1. Average
 - 2. Uniformity
 - C. Compaction
 - 1. Testing
 - 2. Contractor Coring
 - 3. Compaction Payment Schedule
- 408.06 METHOD OF MEASUREMENT
- 408.07 BASIS OF PAYMENT

SECTION 409
HOT BITUMINOUS PAVEMENT
QUALITY CONTROL/QUALITY ASSURANCE

- 409.01 DESCRIPTION
- 409.02 MATERIALS
- A. Bitumen
 - B. Aggregate
- 409.03 EQUIPMENT
- 409.04 CONSTRUCTION REQUIREMENTS
- A. Pit Operations and Stockpiling of Aggregate
 - B. Mix Design
 - 1. NDDOT Developed Mix Design
 - 2. Contractor Developed Mix Design
- (Sections C through N are specified in the respective sections of 408.04.)
- O. Quality Control Sampling and Testing
 - 1. Control Limits
 - 2. Corrective Action
 - 3. Documentation
 - P. Verification Testing
 - Q. Independent Assurance Testing
- 409.05 ACCEPTANCE
- A. Aggregate
 - 1. Gradation
 - 2. Additional Aggregate Tests
 - B. Bitumen Content
 - 1. Average
 - 2. Uniformity
 - C. Compaction
 - 1. Testing

- 2. Contractor Coring
- 3. Compaction Payment Schedule
- D. General
- E. Dispute Resolution Program
- 409.06 METHOD OF MEASUREMENT
- 409.07 BASIS OF PAYMENT

SECTION 410

HOT BITUMINOUS PAVEMENT SUPERPAVE MIX DESIGN

- 410.01 DESCRIPTION
- 410.02 MATERIALS
 - A. Bitumen
 - B. Aggregate
- 410.03 EQUIPMENT
- 410.04 CONSTRUCTION REQUIREMENTS
 - A. Pit Operations and Stockpiling of Aggregate
 - 1. NDDOT Developed Mix Design
 - 2. Contractor Developed Mix Design
 - B. Volumetric Mix Design
 - 1. Trail Mix Design/Aggregate Blend Determination
 - 2. Final Mix Design/Job Mix Formula Determination
 - 3. Moisture Sensitivity Test
 - 4. Aggregate/Asphalt Supplied Other Than That Used in the Mix Design

(Sections C through N are specified in the respective sections of 408.04.)

 - O. Independent Assurance
 - P. Quality Control Testing
 - Q. Corrective Action
 - R. Verification Testing
 - S. Hot Mix Asphalt Sampling
- 410.05 ACCEPTANCE
 - A. Aggregate
 - 1. Gradation
 - 2. Additional Aggregate Tests
 - B. Bitumen Content
 - 1. Average
 - 2. Uniformity
 - C. Compaction
 - 1. Testing
 - 2. Contractor Coring
 - 3. Compaction Payment Schedule
 - D. Verification Testing/Quality Control Testing Tolerances
- 410.06 METHOD OF MEASUREMENT
- 410.07 BASIS OF PAYMENT

SECTION 411

MILLING PAVEMENT SURFACE

- 411.01 DESCRIPTION

- 411.02 EQUIPMENT
- 411.03 CONSTRUCTION REQUIREMENTS
- 411.04 METHOD OF MEASUREMENT
- 411.05 BASIS OF PAYMENT

SECTION 420

BITUMINOUS SEAL COAT

- 420.01 DESCRIPTION
- 420.02 MATERIALS
 - A. Bitumen
 - B. Cover Coat Material
 - C. Blotter Material
- 420.03 EQUIPMENT
- 420.04 CONSTRUCTION REQUIREMENTS
 - A. Preparation of Surface
 - B. Application of Bitumen
 - C. Cover Coat Material Application
 - 1. Requirements for Cutback Asphalts
 - 2. Requirements for High Float Emulsified Asphalts
 - 3. Requirements for Cationic Emulsions
 - D. Blotter Material Application
 - E. Protection of Traffic and Preservation of the Seal Coat
 - F. Limitations
 - 1. Weather
 - 2. Operational
- 420.05 METHOD OF MEASUREMENT
- 420.06 BASIS OF PAYMENT